EPA Region 5 Records Ctr.

361628

REMEDIAL DESIGN WORK PLAN

HIMCO SITE
ELKHART, INDIANA

Prepared For:
Himco Site Trust

OCTOBER 2008
REF. NO. 039611 (2)
This report is printed on recycled paper.

Prepared by:
Conestoga-Rovers & Associates

651 Colby Drive
Waterloo, Ontario
Canada N2V 1C2

Office: 519•884•0510
Fax: 519•884•0525

TABLE OF CONTENTS

TABLE OF CONTENTS

Page

LIST OF FIGURES
(Following Text)

LIST OF TABLES
(Following Text)

LIST OF APPENDICES
(under separate cover)

LIST OF ACRONYMS

ARARs	Applicable or relevant and appropriate requirements
bgs	Below ground surface
CAEPA	California Environmental Protection Agency
CD	Consent Decree
CDA	Construction Debris Area
CIP	Community Involvement Plan
COC	Contaminant of Concern
CRA	Conestoga-Rovers & Associates
DO	Dissolved oxygen
e:Dat	Electronic data acquisition tool
FID/PID(s)	Flame ionization/photoionization dual detector
FSP	Field Sampling Plan
ft AMSL	Feet Above Mean Sea Level
ft bgs	below ground surface
ft/ft	Feet per foot
ft/day	Feet per day
ft/year	Feet per year
GCMS	Gas chromatograph mass spectrometer
GMP	Gas monitoring probe
HASP	Health and Safety Plan
HI	Hazard Index
HSA	Hollow stem auger
IDEM	Indiana Department of Environmental Management
IDW	Investigation derived waste
in.W.C.	Inches of water column
LEL	Lower explosive limit
LFG	Landfill gas
NAD	North American Datum
NMOCs	Non-methane organic compounds
NAVD	North American Vertical Datum
NPL	National Priority List
NTUs	Nephelometric turbidity units
MCL	Maximum contaminant level

LIST OF ACRONYMS

mg/L	Milligrams per liter
mL/min	Milliliter per minute
mS/cm	MilliSiemen per centimeter
MS/MSD	Matrix spike/matrix spike duplicate
ORP	Oxidation-reduction reaction potential
PAHs	Polynuclear aromatic hydrocarbons
PID	Photoionization detector
PPE	Personal protective equipment
PRGs	Preliminary remediation goals
PSDs	Performing settling defendants
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial action objectives
Redox	Oxidation-reduction potential
RD	Remedial Design
RD/RA	Remedial Design and Remedial Action
RD Work Plan	Remedial Design Work Plan
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAP	Sampling and Analysis Plan
Site	Himco Site
SIM	Selected Ion Monitoring
SOPs	Standard Operating Procedures
SOW	Statement of Work
SSI/SCR	Supplemental Site Investigation/Site Characterization Report
USACE	United States Army Corp of Engineers
USGS	United States Geologic Survey
USEPA	United States Environmental Protection Agency
U.S. DOL	United States Department of Labor
USCS	Unified Soil Classification System
VAS	Vertical Aquifer Sampling
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This Remedial Design Work Plan (RD Work Plan) has been prepared in accordance with Section VI, Paragraph 11 of the Consent Decree (CD) for Remedial Design and Remedial Action (RD/RA) for the Himco Site (Site) in Elkhart, Indiana. Conestoga-Rovers & Associates (CRA) was retained by the Performing Settling Defendents (PSDs), collectively known as the Himco Site Trust, to prepare this RD Work Plan.

The Site is a closed, unlicensed landfill located at the intersection of County Road 10 and the John Weaver Parkway (formerly Nappanee Street Extension) in Cleveland Township, Elkhart County, Indiana. The Site is approximately 60 acres in size, and accepted waste such as household refuse, construction rubble, medical waste, and calcium sulfate between 1960 and 1976. The landfill was closed in 1976.

The Site location is shown on Figure 1.1. A layout of the Site, including property boundaries is provided on Figure 1.2.

The Site consists of two major areas: the landfill, which is covered with calcium sulfate and a layer of sand, and the 4-acre construction debris area (CDA) located on the northern portion of seven residential properties and one commercial property. The current owners of the properties located within the Site are listed on Figure 1.2.

The Site was proposed for the National Priorities List (NPL) in 1988 and was placed on the NPL in 1990. The RD/RA is being conducted pursuant to the CD, which became effective on November 27, 2007. The lead Agency for the Site is the United States Environmental Protection Agency (USEPA) Region 5. The Indiana Department of Environmental Management (IDEM) is the support Agency.

The following sections discuss the goals for the RD/RA and organization of this RD Work Plan.

1.1 PURPOSE

The purpose of this RD Work Plan is to document the overall management strategy for performing the design, construction, operation, maintenance and monitoring of the remedial action (RA), as required by Section III and Section IV of the Statement of Work (SOW) included in Appendix B of the CD. This RD Work Plan documents the responsibility, authority, and qualifications of the organizations and key personnel implementing and directing the remedial design (RD). A schedule to complete the RD activities is also included in this RD Work Plan.

1.2 WORK PLAN ORGANIZATION

This RD Work Plan is organized as follows:

- Section 2.0 provides background information on the Site, including regional hydrogeology and geology;
- Section 3.0 describes the scope of work for the RD/RA;
- Section 4.0 presents our recommended approach for the Pre-Design Investigation, including assumptions critical to the development of the scope of the investigation;
- Section 5.0 describes the phases of the RD;
- Section 6.0 presents the project schedule;
- Section 7.0 describes the responsibility and authority of the organizations implementing the project, and the qualifications of key project personnel; and
- Section 8.0 summarizes the PSDs' role in the Community Relations Plan.

In accordance with Section III, Task 1 of the SOW, this RD Work Plan includes a Field Sampling Plan (FSP) in Appendix A, a Quality Assurance Project Plan (QAPP) in Appendix B, and a Health and Safety Plan (HASP) in Appendix C. These documents are bound separately for ease of review by the Agencies and ease of use by the project team.

2.0 SITE BACKGROUND AND SETTING

2.1 SITE DESCRIPTION

The Site is a closed, unlicensed landfill located at the intersection of County Road 10 and the John Weaver Parkway (formerly Nappanee Street Extension) in Cleveland Township, Elkhart County, Indiana. According to the Amended Record of Decision (ROD), the Site is approximately 60 acres in size, and accepted waste such as household refuse, construction rubble, medical waste, and calcium sulfate between 1960 and 1976. According to the Remedial Investigation/Feasibility Study (RI/FS) (SEC Donahue, 1996), an estimated two thirds of the waste in the landfill is calcium sulfate. The landfill was closed and covered with a 1-foot layer of sand overlying a layer of calcium sulfate in 1976.

The waste on Site is in contact with the water table. The RI/FS states that residents near the Site reported complaints of color, taste, and odor problems in shallow water supply wells as early as 1974. Deeper potable water supply wells were installed for some residents in the 1970s. High levels of sodium in these deep wells eventually lead to the requirement to supply municipal water to these residents in 1990. The presence of a clay confining layer on Site was not confirmed by investigations completed during the RI. According to the 1981 United States Geologic Survey (USGS) report "Hydrologic and Chemical Evaluation of the Ground-Water Resources of Northwest Elkhart County, Indiana" the confining clay layer is absent in the vicinity of the Site.

The Site consists of two major areas: the landfill, which is covered with calcium sulfate and a layer of sand, and the 4-acre CDA located on the northern portion of seven residential and one commercial property. Soil samples collected from the landfill and areas surrounding the landfill contained low concentrations of volatile organic compounds (VOCs) and arsenic, both of which are believed by USEPA to be associated with the Site. Polynuclear aromatic hydrocarbons (PAHs) were also detected in soil samples from the south-central portion of the landfill. Soil samples collected from the CDA during the RI contained PAHs and metals (particularly arsenic) that may be associated with CDA dumping activities. Total VOCs in waste mass gas samples collected during the RI were low. According to the reports prepared by USEPA and the United States Army Corps of Engineers (USACE), soil gas samples collected east and south of the landfill contained VOCs at low concentrations, but demonstrated that soil gas-containing VOCs are migrating from the landfill and would need to be collected.

Surface water and sediment samples collected from the three on-Site ponds during the RI revealed very limited contamination. USEPA concluded that no further action would be required for the ponds.

Groundwater on Site flows southeast in three water-bearing units. The predominant vertical hydraulic gradient is downwards according to the Supplemental Site Investigation/Site Characterization Report (USEPA, December 2002) (SSI/SCR), but may in fact be upwards, as observed regionally. Historic groundwater samples collected from the Site contained general chemistry parameters (such as sodium), low part-per-billion concentrations of VOCs and sporadic detections of metals. A "hot spot" of VOCs contamination in groundwater was identified on the south side of the landfill, where seventy-one 55-gallon drums of waste, including toluene, were removed in 1992.

To date, including during post-RI sampling, only low-level groundwater contamination has been detected off Site. The RI concluded that the greatest potential for contaminant migration from the Site is through the groundwater pathway. The exposure pathways identified by the baseline risk assessment completed for the Site include ingestion of contaminated groundwater, incidental ingestion of contaminated soil, and inhalation of VOCs in groundwater and soil gas.

2.2 SITE SETTING

The Site is bordered to the north by a quarry pond and agricultural land; to the east by the John Weaver Parkway (formerly Nappanee Street Extension), and beyond by residential properties; to the south by residential properties and County Road 10; and to the west by undeveloped land and agricultural properties.

The Site is currently fenced. A locked gate is present at the southeast corner of the Site.

2.3 GEOLOGY

2.3.1 REGIONAL GEOLOGY

The bedrock beneath northwest Elkhart County is the Devonian and Mississippian aged Ellsworth and Coldwater shale. These strata from part of the Michigan Basin dip gently to the northeast. The Ellsworth shale ranges in thickness from 39 feet to 196 feet.

Bedrock topography is highly variable and the bedrock surface ranges from about 300 to 650 feet above mean sea level (ft AMSL) beneath Elkhart County. Figure 2.1 provides a map of the bedrock surface beneath northwest Elkhart County. A major bedrock valley has been delineated in the immediately vicinity of the Site. The typical elevation of the bedrock surface in northwest Elkhart County is between 550 and 600 ft AMSL. The north-south trending bedrock valley is incised to 350 ft AMSL. Bedrock was encountered at an approximate depth of 500 feet at a well drilled by the USGS approximately 1,000 feet southwest of the landfill.

A thick sequence of glacial outwash deposits, ranging in thickness from 85 feet to 500 feet overlies the bedrock. These deposits contain thick layers of sand and gravel with interbedded silt and clay layers. A regionally extensive silt and clay layer is present in the overburden sequence. It has a maximum thickness of 80 feet and averages 20 feet thick.

2.3.2 SITE GEOLOGY

A regional geologic cross section through the Site is provided on Figure 2.2. The Site is underlain by a thick sequence of sand. Most of the shallow (less than 50 feet deep) sands are fine to coarse grained well graded sand with a lesser amount of gravel or medium grained poorly graded sand with trace amounts of gravel. Some layers of well graded gravel, up to 25 feet thick, are also present. No silt or clays were present in the shallow overburden.

Seven wells in the immediate vicinity of the Site were installed to depths greater than 100 feet. However, these deeper wells were installed using the air rotary drilling method. Representative soil samples are not recovered using this drilling method. Rather, soil from the borehole is entrained as "cuttings" in compressed air that is circulated in the borehole. Stratigraphic logs are compiled by noting changes in the composition of the cuttings with depth, but the reliability of these logs is less certain than those logs compiled from representative soil samples.

Numerous silt and/or clay layers 2 feet to 20 feet thick were noted at some of the deep well locations. At other locations, no clay layers were noted. Given the poor quality of the stratigraphic information it cannot be determined if these silt and clay layers represent the continuous regional confining layer or if they represent isolated, discontinuous lenses.

Four of the deep boreholes were drilled into the bedrock underlying the overburden. The depth to bedrock ranged from 174 feet below ground surface (ft bgs) northeast of the landfill to 489 ft bgs northwest of the landfill.

2.4 HYDROGEOLOGY

2.4.1 REGIONAL HYDROGEOLOGY

The overburden consists of three main hydrogeologic units:

1) the unconfined upper aquifer,
2) a confining clay layer, and
3) a confined or semi-confined lower aquifer.

The upper aquifer is composed primarily of sand and gravel. Regionally, its thickness ranges from 0 to 116 feet (Arihood and Cohen, 1997). It ranges from 100 to 150 feet thick in the vicinity of the Site. One to 3-foot thick lenses of silt and clay are present within the upper aquifer but have limited effect on regional groundwater flow.

The confining clay layer was encountered in a number of deep wells south of the Site at depths of approximately 50 to 100 ft bgs. It is composed of silt and clay with lenses of sand and gravel. The thickness of the confining clay ranges from 0 to 175 feet, but is typically less than 50 feet thick.

The lower aquifer is composed primarily of sand and gravel with lenses of silt and clay. The lower aquifer is 0 to 335 feet thick across the region but is typically about 35 feet thick. There is a general trend of increasing thickness to the north.

Overburden groundwater in the area flows south towards the St. Joseph River and smaller streams. Groundwater elevations adjacent to the St. Joseph River are typically several feet higher than the adjacent surface water elevation, indicating that groundwater discharges to the river.

Currently, three well fields, the North Main Street Wellfield, the South Wellfield and the Northwest Wellfield provide the water supply for the City of Elkhart. In 2003, 331 billion gallons of drinking water were pumped from the well fields. The closest well field to the Site is the North Main Street Wellfield located approximately 1.5 miles east-southeast of the Site. According to historic documents for the Site, other industrial groundwater users are also present in the vicinity of the Site. The Bayer HealthCare site was the largest industrial user of groundwater up until approximately 2003, pumping approximately one to three million gallons per day from four deep (approximately 150 feet) and three shallow (<50 feet) wells. Bayer's well water pumping ceased and the wells were abandoned after 2003.

Groundwater flow in the upper aquifer does not appear to be influenced by the groundwater extraction at the municipal well fields or the industrial users. However, groundwater flow in the lower aquifer is influenced by this groundwater extraction. These large-volume pumping wells are completed in the lower aquifer to maximize well yield and it is apparent that, at least locally, the confining layer effectively isolates the upper aquifer from the effects of pumping.

Groundwater elevations fluctuate in response to infiltration of precipitation, discharge to surface water bodies and changes in pumping from the aquifer. Groundwater elevations in the region typically fluctuate 2 feet to 5 feet per year with the lowest groundwater elevations in September and October and the highest groundwater elevations in April and May. In the vicinity of the pumping wells the changes in groundwater elevation are more extreme, up to 20 feet, and are controlled by the pumping rate.

Routine groundwater elevations were measured in the northwest portion of Elkhart County during the 1980s for a study on groundwater resources conducted by the USGS (Duwelius and Silcox, 1991). The horizontal hydraulic gradient north of the Site was 0.0015 feet per foot (ft/ft) in both the upper and lower aquifer. South of the Site the horizontal hydraulic gradient was steeper and averaged 0.0027 ft/ft. In the confined aquifer in the vicinity of the areas of pumping near the Site the horizontal hydraulic gradient increased even more, up to 0.009 ft/ft.

Groundwater elevation data measured during the USGS Study indicated that vertical hydraulic gradients were steepest in the vicinity of streams and pumping wells. In the vicinity of streams, the vertical hydraulic gradient was directed upward, consistent with groundwater discharge to surface water. Adjacent to pumping wells, the vertical hydraulic gradient was directed downward, which reflects the cone of depression generated in the lower aquifer by pumping. Away from streams and pumping wells, the horizontal hydraulic gradient was slight and its direction was variable.

Average values of hydraulic conductivity in the Elkhart area were calculated by Imbrigiotta and Martin (1981). They used values of 80 feet per day (ft/day) and 400 ft/day. Typical hydraulic conductivity calculated from pumping tests conducted in the vicinity of the Site ranges from 50 to 200 ft/day. Some of the large water supply wells in the area are capable of yielding in excess of 2,000 gallons of water per minute. The hydraulic conductivity in the vicinity of these wells is typically 500 to 1,500 ft/day. The lower end of this range of values is typical of clean sand and the higher end of the range is typical of gravel deposits.

Duwelius and Silcox (1991) also estimated groundwater velocity by comparing peak bromide concentrations over several years in groundwater samples collected from monitoring wells located downgradient of the Site. The estimates of the groundwater migration rate ranged from 1.1 to 1.7 feet per year (ft/year).

2.4.2 SITE HYDROGEOLOGY

Detailed hydrogeologic information is not generally available for the Site. Monitoring wells have been installed, but representative soil samples were not collected during most of the well installations. When representative soil samples were collected they were typically limited in number and did not provide complete stratigraphic information. Also, a limited number of synoptic groundwater elevation measurements were collected from the wells, limiting the information available to interpret groundwater flow conditions. The PSDs have planned additional investigative activities to address these data gaps.

A regional geologic cross section through the Site is provided on Figure 2.2. In this interpretation of Site conditions the semi-confining clay layer is not present beneath the Site. Numerous silt and/or clay layers 2 feet to 20 feet thick were noted in some of the stratigraphic logs for wells near the Site. Silt and/or clay layers were not noted at other well locations. Given the poor quality of the stratigraphic information it cannot be determined at this time if these silt and clay layers represent the continuous regional confining layer or if they represent isolated, discontinuous lenses.

As shown on Figure 2.2, the lower aquifer was over 175 feet thick and is filled with interbedded sand and sand and gravel in the bedrock valley east of the Site.

The depth to groundwater in the vicinity of the Site is relatively shallow, ranging from less than 10 feet to 25 feet bgs with typical depths ranging from 10 to 15 feet bgs. The elevation of groundwater in the vicinity of the Site ranges from 750 to 700 ft AMSL.

Groundwater flow direction and gradients for the central portion of the Site are speculative because there are no wells completed through the waste material.

Groundwater elevation monitoring data reported in the SSI/SCR show that shallow and intermediate groundwater flow is to the south to slightly southeast beneath the entire Site. USACE speculated that if the water table was mounded beneath the waste material then a radial groundwater flow pattern, with significant groundwater flow to the southeast to east may exist beneath the Site.

The SSI/SCR also reported that surface water elevations at the three ponds located on the Site were slightly higher than nearby groundwater elevations, indicating that the ponds were at least seasonal sources of groundwater recharge.

3.0 RD/RA SCOPE OF WORK

3.1 ROD AND SOW

To date, all investigations of the Site have been completed under the direction of the USEPA. The 2004 Amended ROD, which replaces the previous ROD developed in 1993, addresses risks to human health not fully addressed by the earlier ROD. The key components of the remedy for the Site are as follows:

i) Landfill cover assessment and repair;

ii) Landfill gas collection system;

iii) Site security, maintenance, and institutional controls;

iv) CDA remedy (excavation and removal of soil and debris or placement of soil cover over soil and debris);

v) Residential well abandonment and groundwater institutional controls;

vi) Municipal water connections;

vii) Groundwater investigation and long-term monitoring; and

viii) Removal of surficial debris.

The RD/RA for the Site consists of six tasks, as outlined in the SOW:

i) RD Work Plan;

ii) Remedial Design Phases;

iii) Remedial Action Work Plan;

iv) Remedial Action/Construction;

v) Operation & Maintenance; and

vi) Performance Monitoring.

Due to the number of components of the RA and the phased approach appropriate for the scope of work, the RD and RA Work Plans will consist of a series of submittals to the Agencies. The RA will also be completed in a phased approach.

In order to expedite the municipal water connections portion of the work and the associated abandonment of private supply wells, the work plan for these components of the RD/RA is provided under separate cover. As previously discussed with USEPA, the scope of work for the municipal water connections and private water supply abandonments is prescribed in the CD and SOW, and does not require an extensive pre-design investigation. As such, the PSDs hope that USEPA is able to approve the RD Work Plan for Residential Well Abandonment and Municipal Water Supply in the near future and address residents' concerns about the existing water supply.

4.0 PRE-DESIGN INVESTIGATION

4.1 BOUNDARY AND TOPOGRAPHIC SURVEY

Survey data will be collected to complete topographic information in the area of the Site as bounded by northing N1534000 to the north, easting E405000 to the west, John Weaver Parkway (formerly Nappanee Street Extension) to the east, and County Road 10 to the south. The location of all boreholes, test pits, monitoring wells, gas probes, staff gauges, and fencelines will be determined and reported in Indiana State Plane Grid Coordinates. Off-Site monitoring wells will also be surveyed. Elevations at 50-foot intervals will be surveyed relative to the 1983 Indiana East State Plane Coordinate System North American Datum (NAD) for horizontal control and the North American Vertical Datum (NAVD) of 1988 for vertical control. As summarized in Section 2.1.1 of the FSP (Appendix A), horizontal locations will be surveyed to the nearest 0.1-foot. Elevations for all monitoring well reference points (new and existing) will be surveyed to the nearest 0.01-foot. A topographic map with 2-foot contours will be produced for the new base map.

The Site survey will be used to develop an accurate Site plan including topographic contours. Subsequently, the Site plan will be used as the base for RD drawings. The updated topographic base plan will be developed at a scale and contour interval that allows an assessment of drainage patterns on Site and in the vicinity of the Site, and can be used to design modifications to the existing landfill cover.

As summarized in Section 4.2, the surveyor will also lay out the limits of the landfill as determined during the Final Design Analysis (USACE, 1996) using wooden stakes. Additional surveying will also be required as part of the RD Work Plan for Residential Well Abandonment and Municipal Water Supply, which has been submitted to USEPA under separate cover.

4.2 LANDFILL/LANDFILL COVER INVESTIGATION

CRA will complete a pre-design investigation in accordance with Section II, Paragraph 4.1 of the SOW to delineate the limits of the landfill, characterize on-Site soil (depth, nutrients, vegetation, and grain size), and to determine the need for additional soil cover. Additional investigation of the CDA will also be completed in order to select the appropriate remedy to address soil and debris in the CDA in accordance with Section II, Paragraph 6 of the SOW.

A description of the proposed investigation is provided below. Field sampling procedures are provided in Section 2 of the FSP (Appendix A).

4.2.1 WASTE DELINEATION

Test trenches will be used to confirm the delineated extent of waste and cover material around the perimeter of the landfill. The 1996 estimated landfill limit will be surveyed prior to test trenching activities.

Test trenches will be excavated at or near the 1996 landfill limits as shown on Figure 4.1. Each test trench will be up to 30 feet long by 3 feet wide, and the outer limit of the trench will extend to the bottom of the fill. The test trenches will start from the landfill and move outwards until the horizontal limit of fill is confirmed. Excavation will not be completed beyond the depth of the water table, and will generally be less than 5 feet deep. If the horizontal limit of the landfill is not determined in any planned test trench, the trench lengths will be extended or moved until the edge of fill is located, to the extent practical. The nature and depth of fill material will be visually identified and recorded as described in Section 2.1 of the FSP.

This information will be used, in conjunction with historic electromagnetic survey results, to define the lateral area of waste material to be covered.

Soil samples will not be collected from the test trenches as the purpose of this task is to delineate the extent of waste.

4.2.2 COVER EVALUATION

In order to determine the condition of the existing landfill cover, CRA will complete a pre-design soil cover survey. This study will include:

- advancement of shallow boreholes through the soil cover on a 100-foot grid;
- examination of collected soil samples to determine the thickness of the soil cover at various points across the Site;
- a physical inspection of the landfill to identify areas of settlement, erosion, and poor vegetation (possibly resulting from hydrogen sulfide gas accumulation);
- documentation of the presence of invasive species; and
- documentation of exiting vegetation that will not be disturbed during the RA.

Figure 4.2 presents the 100-foot soil sampling grid for the cover evaluation. As described in Section 2.1 of the FSP (Appendix A), a direct push drilling rig or Geoprobe® will be used to sample to a depth of 24 inches to determine the thickness of the existing cover materials. Continuous soil samples will be collected and examined by a CRA geologist or field technician. CRA will log the soil type, stratigraphy (if any), moisture, color, and visual and olfactory evidence of impact. A representative soil sample from each location will be placed in a sealable bag (such as Ziploc®) and the headspace will be screened for total VOCs with a photoionization detector (PID). Soils will be described and classified according to the Unified Soil Classification System (USCS) and the United States Department of Agriculture (USDA) textural classification chart.

One cover soil sample per 2 acres will be collected and analyzed for grain size distribution, pH, organic carbon content, nitrogen content, phosphorus and potassium to determine the ability of the soil to support vegetative growth. The location of the soil samples will be adjusted in the field to areas of cover that appear to be infertile while generally maintaining the proposed spacing and sampling frequency. Soil samples will be compared to criteria provided in Table 4.4 as appropriate.

CRA will also complete a physical inspection of the landfill cover, identifying areas of vegetative stress, erosion (especially locations of deep gouges through the cover indicating continuous erosion), exposed waste, and settlement locations that will require additional soil cover.

The vegetation to remain as part of the final cover will be surveyed using information from the physical inspection. Areas of the cover that will not be disturbed as part of the cover system improvements will be surveyed for invasive species. The findings from the inspection will be summarized and incorporated into the landfill cover design and submitted to USEPA as part of the Preliminary (60%) Design submittal.

4.2.3 CONSTRUCTION DEBRIS AREA (CDA)

The CDA is approximately 4 acres in size and is subdivided into seven residential and one commercial property parcel along the southern perimeter of the landfill. These parcels contain a mixture of small piles of rubble, concrete, asphalt, and metal debris. The CDA was previously defined using 10 test trenches in 1991 during the second phase of field studies for the RI. Soil samples were collected from land parcels D, F, M, O, P, and S shown on Figure 1.2. No soil samples were obtained from land parcels N, Q, R, and T.

CRA will perform a qualitative assessment of the ground surface conditions within the CDA during the Site reconnaissance activities described in Section 4.3 and Section 4.4 of this RD Work Plan. The purpose of the assessment is to inventory the surface rubble and debris visible within the CDA that pose a tripping hazard and should be removed in accordance with Section II, Paragraph 6.1 of the SOW.

Section II, Paragraph 6.2 of the SOW allows the PSDs to either remove the material in the CDA down to 6 feet bgs, or cover it with 18 inches of soil. Since the CDA is comprised of eight privately-owned properties, test pits are proposed in parcels not previously sampled by the Agencies. Five test pits will be excavated as shown on Figure 4.3 to determine the depth of construction debris. Each test pit will be approximately 6 feet long by the width of the excavator bucket and will be approximately 6 feet deep. The nature and depth of fill material will be visually identified and recorded.

Soil samples will also be collected at the test pit locations to confirm that the soil quality is consistent with the 1998 data collected by the Agencies, and to help determine the depth of soil impact in the CDA. This will assist the PSDs in determining if it is appropriate to excavate the soil and rubble, or if it is more appropriate to cover it in place. Soil samples will be collected from 0 to 2 ft bgs, from 2 to 4 ft bgs, and from 4 to 6 ft bgs. Soil samples will be analyzed for SVOCs and TAL metals including cyanide. The field sampling procedures are described in Section 2.1 of the FSP.

4.2.4 REMEDIAL DESIGN OF LANDFILL COVER

The following RD work tasks will be conducted once the Pre-Design Investigation field activities have been completed:

- Topographic map of the Site will be prepared using 2-foot contours;
- Develop plan depicting the limit of the landfill based on test trench information and previously-completed electromagnetic surveying fieldwork;
- Identify the location and design of a security fence;
- Prepare plan presenting soil balancing plan (i.e., areas for cut and fill) for the Site based on the landfill cover investigation and topographic survey;
- Compare the soil sample results from the test pits within the CDA to historical information and the soil screening criteria from Table 4.4; and
- Develop the proposed plan for the CDA.

These documents will be presented in the Preliminary (60%) Design submittal, which will be submitted to USEPA in accordance with the schedule discussed in Section 5.0.

4.3 LANDFILL GAS (LFG)/SOIL GAS INVESTIGATION

Section II, Paragraph 4.2 of the SOW requires that the PSDs install a LFG and soil gas management system to address the potential current and future presence of LFG and soil gas in the southern and eastern portion of the Site. The Remedial Action Objectives (RAOs) for the LFG and soil gas collection system, as listed in Section II, Paragraph 4.2 of the SOW, are as follows:

- to prevent inhalation of indoor air that contains carcinogens that present a total excess cancer risk above EPAs acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$ for all Site-related contaminants released from the subsurface vapor migration pathway;
- to prevent inhalation of indoor air that contains non-carcinogens that present a total non carcinogenic Hazard Index (HI) greater than 1.0 for all Site-related contaminants released from the subsurface vapor migration pathway;
- to prevent the future migration of hydrogen sulphide gas and methane gas beyond the boundary of the landfill; and
- to establish a LFG monitoring program that will ensure compliance with all the RAOs listed above for air as well as Applicable or Relevant and Appropriate Requirements (ARARs) listed in the SOW.

The data collected to date indicate the presence of low concentrations of VOCs, particularly chlorinated ethenes and ethanes, in LFG/soil gas samples collected from the southern portion of the Site. Because the RAOs listed above are risk-based, additional data are required in order to determine the risk to residents associated with Site-related contaminants released from the subsurface vapor migration pathway. Further, since soil gas samples have not been collected at the Site since 1999, it is appropriate to collect new data to assess the current concentrations of contaminants in LFG/soil gas near the Site boundary and near residences south of the Site.

The LFG/Soil Gas Investigation proposed herein will identify landfill migration pathways at the Site and permit the development of a RD that meets the RAOs. The RD will appropriately address gas migration at the Site, including provisions (if necessary) for intercepting and capturing gases present in the subsurface environment in the southern portion of the landfill.

The LFG/Soil Gas Investigation will include the following tasks:

- historic data compilation;
- Site reconnaissance, including inspections of gas monitoring probes (GMPs), if any are found;
- gas probe installation and sampling;
- data evaluation;
- Phase II LFG/Soil Gas Investigation, if required based upon Phase I sample results; and
- reporting, including development of the Preliminary (60%) Design submittal.

A detailed description of each task is provided below.

4.3.1 TASK 1 - HISTORIC DATA COMPILATION

All available LFG and soil gas data will be compiled in a database so that data can be easily accessed now and in the future. The database will include the following items:

- LFG extraction well and soil gas probe completion information, including LFG extraction well and soil gas probe depth, screen interval, water elevations, and stratigraphic logs (if available);
- northing, easting, ground surface, and reference elevations; and
- LFG/soil gas data.

CRA has developed a customized GIS software program that integrates site maps and environmental monitoring databases with digital photographs, 3D visualizations, boring logs, and monitoring reports. CRA's Electronic Data Access Tool (e:DAT™) is a stand-alone data access tool that includes an integrated Geographic Information System (GIS), document management tool, and database query engine. CRA will use e:DAT™ to assist in data interpretation and, as appropriate, assist in data review during presentations and meetings.

4.3.2 TASK 2 – SITE RECONNAISSANCE

CRA will complete a Site reconnaissance to determine if GMPs exist, and if they do, if they can be incorporated into the LFG/Soil Gas Investigation.

If GMPs are found, CRA will complete the following activities relative to the GMPs:

- inspect the condition of the protective casings, concrete pads, locks, and caps;
- identify any surface subsidence or surface water ponding in the vicinity of the GMP;
- label each GMP and mark an appropriate reference point (i.e., the top of the GMP riser pipe);
- measure the depth to water (to confirm absent) and sound each GMP;
- confirm the GMP construction and compare to completion logs (if available); and
- record pertinent data in a field book or field forms, file with the project files, and incorporate into e:DAT.

CRA will make arrangements to repair the protective casing and the concrete surface seal of any damaged GMPs deemed necessary for the LFG /Soil Gas Investigation.

CRA will also make note of information pertaining to residential foundation construction (e.g., slab on grade, crawl space, partial/full basement) and building footprint dimensions for the residences located south of the Site. This information is necessary for calculating soil gas attenuation factors following data collection.

4.3.3 TASK 3 – SOIL GAS PROBE INSTALLATION

Assuming that no GMPs exist at the Site, CRA proposes to install 27 soil gas probes as shown on Figure 4.4. Seventeen soil gas probes will be installed along the northern, eastern and southern property boundaries of the Site. Seven soil gas probes will be installed north of residences and along the limit of waste adjacent to the southwest corner of the Site (i.e., in the general vicinity of the proposed USACE GMPs). An additional three soil gas probes will be nests, consisting of one shallow and one deep soil gas probe installed adjacent to and within 10 feet of three existing residences to the south of the Site. The probe installation methods are described in Section 2.2 of the FSP (Appendix A). The final soil gas probe locations will be subject to results of the Landfill Cover Investigations.

CRA will collect and log soil samples on a continuous basis during the advancement of all boreholes, as described in Section 2.2 of the FSP. Representative soil samples will be collected from the soil gas probe nests for the following parameter analyses to permit modeling of vapor gas intrusion:

- porosity and water-filled porosity;
- dry bulk density;
- vapor permeability; and
- fraction of organic carbon content.

Particular attention will be paid to the presence of confining units at each borehole. Since soil gas can migrate above and below a confining unit, CRA will adjust the construction of soil gas probes in the event that CRA observes evidence of a confining unit. Adjustments may include the installation of additional deep soil gas probes and/or soil gas probe nests.

Soil Gas Probes

CRA will install soil gas probes at 200 foot intervals along the eastern boundary (i.e., directly across from alternating residences along John Weaver Parkway) and the southeastern boundary of the Site, as well as at two locations along the northern boundary of the Site, to permit short and long-term monitoring of soil gases at the property boundary and/or compliance boundary.

CRA will install soil gas probes using a two inch diameter Geoprobe® dual-tube direct push technique to minimize formation disturbance. Soil gas probes will comprise 0.5-inch diameter schedule 40 PVC continuous piping (i.e., no joints), a minimum 4 feet of screen perforations, and a minimum of 5 feet of riser pipe. A typical soil gas probe is presented in Figure 4.5. Installation and construction details for the soil gas probes are provided in Section 2.2 of the FSP. In general, soil gas probes will be installed to approximately 3 feet above the local groundwater table.

Soil Gas Probe Nests

CRA will install soil gas probe nests within 10 feet of three occupied residences along the southern boundary of the Site to permit evaluation of vapor intrusion potential.

CRA will install soil gas probe nests using a two inch diameter Geoprobe® dual-tube direct push technique to minimize formation disturbance. Soil gas probe nests will comprise one quarter inch nylon tubing with a one foot long stainless steel screen implant. A typical soil gas probe nest is presented in Figure 4.6. Installation and construction details for the soil gas probes are provided in Section 2.2 of the FSP. Shallow soil gas probes will be installed a minimum of 5 feet below ground surface.

Deep soil gas probes will be installed a minimum of 3 feet above the ground water table. Soil gas probe nests will be set within 2 feet of each other.

4.3.4 TASK 4 - LANDFILL GAS (LFG) / SOIL GAS SAMPLING

Historical records for the Site suggest that two thirds of the waste at the Site is calcium sulfate, with the remainder including paper, plastic, rubber, wood, glass, metal (including wire, auto parts, pipes), and small amounts of hospital waste. Considering the age and characteristics of the waste, the potential for landfill gas generation is low. Thus, only low concentrations of methane, carbon dioxide, VOCs and other trace gases are anticipated in soil gas.

Major Constituent Gases

Baseline soil gas sampling for the major constituent gases (i.e., LFG, including methane, oxygen, carbon dioxide, and balance gases) will be conducted following installation of the soil gas probes. The purpose of the baseline sampling of the soil gas probes is to provide information on gas quality and to confirm that the new installations (and existing GMPs, if useable) are capable of providing representative gas samples.

Baseline soil gas sampling for the major constituent gases will include soil gas pressure and water level. The soil gas pressure will be monitored first using a Dwyer digital manometer (or approved equivalent instrument), as outlined in Section 2.2 of the FSP. Gas quality/combustible gas will then be monitored using a Landtec Gas Extraction Monitor, GEM-500 meter indicator, or equivalent, to measure methane, carbon dioxide and oxygen concentrations. The Landtec is industry-standard equipment that uses an infrared sensor for detection of methane on a percent by volume or percent lower explosive limit (LEL) basis. At all locations where methane contents are below 20 percent of the LEL for methane in air (i.e., 1 percent methane by volume in air), then both a FID and a PID will be used to assist in the field assessment of soil gas quality. If methane levels are above this limit at any location, field instruments will not be used to avoid potential damage to field equipment.

Water levels in the soil gas probes will be measured using a Solinst water level meter. The water level will give an indication as to whether the screened area of the wells is clear or flooded.

After completion of the baseline soil gas-monitoring event, CRA will complete two additional rounds of monitoring for the major constituent gases. Subsequent monitoring events will use the same equipment and monitoring parameters as discussed for the baseline soil gas-monitoring event.

Trace Gases, Nitrogen and VOCs

Based on a review of available Site information, soil gas samples will be analyzed using USEPA Method TO-15 list of VOCs. Soil gas samples will also be analyzed for nitrogen and the following trace gases:

- carbon monoxide;
- hydrogen sulfide; and
- Total non-methane organic compounds (NMOCs).

CRA is proposing two seasonal monitoring events to sample soil gas for trace gases, nitrogen and VOCs. The first round will take place during the summer months, with a second round to occur during the winter months, to evaluate gas migration characteristics under frost cover conditions. Baseline soil gas sampling will take place 48 hours after installation of applicable soil gas probes and will be collected in 6-liter evacuated canisters. Details on sampling protocols and field quality control/quality assurance (QA/QC) procedures for trace gases, nitrogen and VOCs are provided in Attachment B of the FSP.

The soil gas samples will be analyzed using USEPA's Method TO-15 gas chromatograph/mass spectrometer (GC/MS) methodology. This analysis will provide results for VOCs in soil gas. An outdoor ambient air sample will be collected coincident with the soil gas samples to assess potential presence of VOCs in background outdoor air. The outdoor air sample also will be analyzed using method TO-15, but with the MS run in selected ion monitoring (SIM) mode to achieve lower detection limits. Analytical methods for soil gas analyses are provided in the QAPP (Appendix B).

A Phase II LFG/Soil Gas Investigation will be necessary only if the Phase I screening of soil gas samples identifies the presence of compounds of interest along the eastern boundary of the Site. If this is the case, CRA will develop an addendum to this Work Plan for review and approval by USEPA. The Phase II LFG/Soil Gas Investigation, if needed, would consist of occupied residence reconnaissance and installation of additional soil gas probe nests.

4.3.5 TASK 5 - SAMPLE ANALYSIS/DATA VALIDATION

As an initial assessment of the significance of the soil gas sample analytical results, the chemical concentrations detected in the soil gas samples will be compared to, or screened against, chemical-specific generic soil gas screening criteria. IDEM's *Draft Vapor Intrusion Pilot Program Guidance* (IDEM, 2006), specifically Table 2, Indoor Air Action Levels-Residential, presents allowable residential risk-based target indoor air concentrations. Generic soil gas screening criteria will be developed from the 30 year screening level criteria for residential indoor air action levels divided by a soil gas attenuation factor of 0.01 for soil gas samples at a depth greater than 5 feet BGS. The target indoor air concentrations will correspond to those developed by USEPA based on a carcinogenic risk level of 1×10^{-5} and a non-carcinogenic hazard index of 1.0.

The soil gas attenuation factor represents the degree that vapor concentrations are attenuated (i.e., decreased) as they potentially migrate upward from the unsaturated zone, penetrate a building foundation, and mix with building indoor air. A smaller soil gas attenuation factor value represents an increased degree of attenuation. Applying the generic soil gas screening criteria based on a soil gas attenuation factor value of 0.01 is considered to represent a conservative initial screening of the soil gas quality data. This initial screening will be used to identify whether any VOCs are present in soil gas at concentrations that warrant a further detailed assessment. Should any VOCs be detected in soil gas at concentrations greater than the generic soil gas screening criteria, these VOCs will be identified as Contaminants of Concern (COCs), and CRA will prepare and addendum to this Work Plan for review and approval by the USEPA. Any Site-specific attenuation calculations will be included in the addendum. Only default soil gas attenuation values (0.01) will be used under the current plan.

Should it become necessary to collect soil gas samples at depths of less than five feet below a basement floor, the generic soil gas screening criteria will be developed from the 30 year screening level criteria for residential indoor air action levels divided by a soil gas attenuation factor of 0.1.

4.3.6 TASK 6 - DATA EVALUATION

Based on the results of the LFG/Soil Gas Investigation, CRA will:

- determine the most appropriate action for intercepting and controlling subsurface gas migration; and

- complete a review of the weighted average for key VOC compounds vinyl chloride, dichloroethane, benzene, chlorobenzene, ethylbenzene, and m/p-xylene to determine if carbon filtering or other gas treatment process will be required prior to release to atmosphere.

Should CRA conclude that an active gas collection system is in the best interest of the Site, CRA will complete a soil vacuum test at the Site. This test will determine the potential for and nature of permeable connections between select LFG extraction wells and adjacent soil gas probes or GMPs, and will provide valuable information for designing an active LFG collection system. Note that if confining units are discovered during the LFG extraction well or soil gas probe installation, the vacuum response test will determine if gas is migrating at various depths, or if the confining unit is discontinuous with permeable connections above and below the confining unit.

The results of the LFG/Soil Gas Investigation and the preliminary design of the LFG remedy will be presented in the Preliminary (60%) Design submittal.

4.4 EAST AND SOUTHEAST GROUNDWATER INVESTIGATION AND GROUNDWATER MONITORING PROGRAM

Section II, Paragraph 4.3 of the SOW describes the requirements for the groundwater investigation east and southeast of the Site. The purpose of this investigation is to delineate the contaminant plume emanating from the Site and potentially impacting the adjacent aquifer and water supply wells. Section II, Paragraph 5 of the SOW describes the requirements for the Groundwater Monitoring Program intended to characterize the nature and extent of groundwater contamination beneath the Site. The limited amount of Site-specific information, the close proximity of the east and southeast areas to the Site, and the common approach to both investigations make the distinction between these different investigations unnecessary. For example, the same well installation and groundwater sampling methods will be used to investigate groundwater quality in both areas. Information regarding groundwater quality and groundwater flow directions from both areas will be combined to interpret local hydrogeologic conditions. Therefore, for the purposes of this Work Plan, the East and Southeast Groundwater Investigation and the Groundwater Monitoring Program will be described together in the following section. Work associated with abandoning existing residential wells, which is also described in Paragraphs 4.3 and Paragraph 5 of the SOW, is described in a separate Work Plan.

A network of 39 monitoring wells currently exists at the Site. Table 4.1 provides a summary of the details of the wells that have been installed in the vicinity the Site. These wells have not been routinely sampled to date, and many of the wells have not been used for years. One aspect of developing a groundwater monitoring program for the Site will be evaluating the usefulness of the existing monitoring well network shown on Figure 4.7. According to the documents provided to CRA and the comments in the Administrative Record, USEPA has expressed concerns that the existing monitoring well network is not adequate. USEPA has indicated they believe it is possible that contaminants are stratified into discrete zones within the upper aquifer. CRA has experience at several USEPA Region 5 sites where vertical aquifer sampling (VAS) is used to characterize the variations in contaminant distribution with depth in thick sand aquifers. VAS will be utilized at the Site to address this data gap and to ensure any new monitoring wells are installed to the appropriate depths.

The objectives of the groundwater investigations are:

i) delineate the horizontal and vertical extent of groundwater impact from the landfill around the perimeter of the landfill;

ii) delineate the plume contaminating the residential well at 54305 Westwood Drive, immediately east of the Site;

iii) delineate an appropriate buffer zone east of the Site;

iv) delineate groundwater contaminants that may have migrated south of the Site; and

v) provide information required to design an appropriate monitoring well network.

The groundwater investigation will be performed in phases based on the portion of the Site being investigated and the target depths of the investigation. A phased approach permits information collected during the initial stages of the investigation to be used to guide subsequent phases of the investigation. VAS will be completed at all proposed monitoring well locations to delineate the concentration and extent of groundwater contamination and identify the appropriate depth for future monitoring wells. The appropriateness of existing monitoring wells will be evaluated based on the results of the VAS, as will the design of new monitoring wells. Hydraulic information will be collected to evaluate the groundwater flow regime in the vicinity of the Site to guide future plume delineation. Groundwater sampling of the existing and proposed wells will also be completed to further characterize groundwater quality beneath the Site.

The Phase I Groundwater Investigation will consist of the following tasks:

- historic data compilation;
- monitoring well reconnaissance & survey;
- baseline groundwater sampling; and
- VAS.

The Phase II Groundwater Investigation will consist of the following tasks:

- VAS;
- new monitoring well installation; and
- interim groundwater water monitoring.

The Phase III Groundwater Investigation will consist of the following tasks:

- VAS, if required;
- new monitoring well installation, if required; and
- groundwater monitoring.

The Phase I Groundwater Investigation VAS will be focused on the south west portion of the landfill and downgradient areas and limited to 150 feet in depth. Subsequent phases of the Groundwater Investigation will further refine the horizontal and vertical delineation of any plumes emanating from the Site, document background groundwater quality, and define appropriate locations and depths for sentry monitoring wells.

4.4.1 HISTORIC DATA COMPILATION

Available groundwater elevation and groundwater quality data will be compiled in a database so that it can be easily accessed for this investigation and any future needs. The well completion information will be included in the database. Northing, easting, ground surface elevation, reference elevation, well depth, and screen interval information will be compiled and included in the database. Stratigraphic logs and any relevant construction diagrams will be scanned so that they can be accessed using e:DAT.

Groundwater elevations were measured in April 2000 and included in the SSI/SCR. These data will be compiled and included in the database. If additional synoptic groundwater elevation data are available in the SSI/SCR or in the Final Design Analysis (USACE, July 1996) it will be compiled and included in the database.

Numerous groundwater samples have been collected and analyzed for a variety of parameters. However, not all wells were included in all groundwater sampling events and the analytical parameters varied between monitoring rounds. CRA will compile the groundwater quality data included in previous reports to the extent that USACE is able to provide CRA with tabulated data. Original laboratory analytical reports will be used to check the accuracy of the data where available.

4.4.2 MONITORING WELL RECONNAISSANCE & SURVEY

All existing monitoring wells located on or in the vicinity of the Site will be included in the well reconnaissance. The purpose of the reconnaissance is to determine the condition of the existing wells prior to sampling.

CRA will locate wells in the field and will inspect the above ground features of each well. The condition of the protective casing will be inspected, including the condition of the well cap and the lock for the protective casing. Any cracks in the surface seal will be noted, as well as any subsidence or surface water ponding in the vicinity of the well. The well will be clearly labeled and a suitable reference point, usually the top of the riser pipe will also be clearly marked.

CRA will measure the depth to water in each well and will sound the depth of each well. The depth to the bottom of the well will be compared to the depth to the bottom of the well screen from the well installation log. This information will be used to confirm the well identification and evaluate the amount of silt (if any) present in the bottom of the well screen.

The information collected during the well reconnaissance will be recorded in the field book or on field forms that will be filed with the project files, as described in the FSP (Appendix A).

CRA will make arrangements for any necessary repairs to be made to the protective casing and the concrete surface seal. Since the wells have not been monitored for years, CRA will re-develop each well prior to sampling to ensure the well is functioning properly.

The existing monitoring wells will be included in the topographic survey of the Site described in Section 4.1. The location of all monitoring wells will be determined and reported in Indiana State Plane Grid Coordinates to the nearest 0.1-foot. Elevations for all monitoring well reference points will be surveyed to the nearest 0.01-foot. The survey will be relative to the 1983 NAD for horizontal control and the NAVD of 1988 for vertical control.

4.4.3 BASELINE GROUNDWATER SAMPLING

CRA will complete a baseline groundwater sampling round after the well reconnaissance and well re-development are complete. The purpose of this sampling is to confirm that the wells are capable of providing representative groundwater samples and to establish current groundwater quality. The results of the baseline groundwater sampling will be used to design routine groundwater monitoring programs.

The parameter list for the baseline sampling will include TCL SVOCs, TAL metals including cyanide and selected general chemistry parameters, as summarized in Table 4.1. Section II, Paragraph 5.1.1 of the SOW describes the analytical parameters for the groundwater quality monitoring program. PCBs and pesticides are included in the parameter list. CRA has reviewed the available groundwater sampling data. PCBs were analyzed in 78 groundwater samples collected between 1990 and 2000. None were detected. Similarly, 80 groundwater samples were analyzed for pesticides between 1984 and 2000. Alpha-BHC was detected in two of the groundwater samples, as follows:

Well	*Date*	*Concentration ($\mu g/L$)*	*Qualifiers*	*Comments*
WT111A	9/22/1995	0.012	JP	Estimated, possible
WT114B	9/21/1995	0.012	J	Estimated

There is no MCL for alpha-BHC. The existing data demonstrates that PCBs have never been detected and pesticides have only very rarely been detected in groundwater samples collected in the vicinity of the Site. Therefore, continued sampling and analysis of groundwater samples for these compounds is not appropriate.

Section II, Paragraph 5.1.1 of the SOW also includes "human effective compounds" in the groundwater parameter list. Tables 11 and 12 of the ROD Amendment provide the results of analysis of groundwater samples collected from four wells in the vicinity of the Site. Two of the wells, WT116A and 54305 Westwood Drive, are already impacted by other contaminants, some at concentrations that exceed their respective MCLs. The "human effective compounds" are detected rarely and the results are qualified as estimated and/or also detected in laboratory blanks. Also, there are no standard analytical methods for most of these parameters and no MCLs. Therefore, sampling and analysis of groundwater samples for "human effective compounds" is not appropriate.

Groundwater samples will be collected using low flow or low stress groundwater sampling techniques. Employing low flow groundwater sampling techniques ensures that every reasonable effort is made to collect representative groundwater samples. Low flow or low stress groundwater sampling involves pumping the well at a sufficiently low flow rate so that no drawdown occurs in the well. Groundwater parameters such as pH, temperature, dissolved oxygen and turbidity will be monitored during the well purging, and groundwater samples will be collected once these parameters have stabilized. CRA's review of well sampling records from the Site suggests that low flow sampling techniques are appropriate for all existing monitoring wells. Low flow purging and sampling will be done using a variable speed electric submersible pump, as described in Section 2.3 of the FSP (Appendix A). However, if conditions warrant, other pumps may be selected. QA/QC samples will also be collected to ensure the groundwater monitoring data can be properly validated in accordance with USEPA protocols. CRA will validate the groundwater analytical data as described in the QAPP (Appendix B).

4.4.4 PHASE I VERTICAL AQUIFER SAMPLING

The range of potential depths for drilling and VAS dictates that one drilling/sampling method will not be an efficient means of collecting the required data. A variety of drilling and groundwater sampling techniques will be used for the groundwater investigation. In general, the term "shallow" applies to depths of less than 60 ft bgs, "intermediate" applies to depths between 60 and 100 ft bgs, and "deep" refers to depths greater than 100 ft bgs. With respect to drilling boreholes and installing monitoring wells, these general depth terms are only guidelines. The depths for which different drilling and sampling techniques are employed will be based on actual ground conditions encountered while drilling.

Shallow boreholes and groundwater sampling will be completed using a direct push drill rig and screen point sampler, as described in Section 2.3 of the FSP (Appendix A). This is consistent with some of the previous investigations completed by the Agencies at the Site. Deep boreholes and groundwater sampling will be completed using a rotosonic drill rig or a hollow stem auger (HSA) drill rig and the Simulprobe® groundwater sampler or equivalent. Other drilling and groundwater sampling techniques may be feasible, depending on Site-specific ground conditions. If necessary, CRA will advise the Agencies of other drilling techniques proposed for use prior to use of those techniques in the field, and will provide the Agencies with an amendment to the FSP if the sampling methodology will be significantly different from that described in this RD Work Plan.

The locations of the VAS boreholes proposed for the Phase I Groundwater Investigation are shown on Figure 4.8. The following is the rationale for the proposed VAS boreholes:

	Rationale
Landfill Area	
VAS-01	Verify northeastern and vertical plume(s) limits
VAS-101	Verify eastern and vertical plume(s) limits
VAS-116	Verify core of plume and vertical plume(s) limits
VAS-117	Verify western and vertical plume(s) limits
Eastern off Site	
VAS-114	Confirm WT114A/B results and delineate vertical plume(s) limits
VAS-120	Determine downgradient plume(s) limits, possible downgradient sentinel well location
Southern off Site	
VAS-105	Verify southern and vertical plume(s) limits
VAS-106	Verify southern and vertical plume(s) limits

VAS boreholes VAS-01, VAS-101, VAS-116, and VAS-117 will be installed around the southern and eastern perimeter of the landfill. These boreholes will be completed at existing monitoring well nests. This will allow the suitability of the existing wells for continued long-term monitoring to be evaluated. The exact location of the boreholes will be based on Site access limitations. The groundwater samples will be analyzed for screening compounds that will include the TCL VOCs and selected general chemistry parameters summarized in Table 4.2. The shallow interval will be investigated first by installing boreholes to a depth of approximately 60 feet and collecting groundwater samples at 10-foot intervals. The results of the shallow Phase I Groundwater Investigation VAS boreholes will be evaluated against screening level criteria, then the intermediate and deep Phase I Groundwater Investigation VAS borehole will be installed and groundwater samples will be collected. These data will be used to develop the Phase II Groundwater Investigation and scope of the Phase II VAS program.

Historic groundwater data indicate that residential wells located east of the Site have been impacted by Site-related contaminants. Initially, VAS borehole VAS-114 will be installed in the vicinity of the residential well at 54305 Westwood Drive. This is the location of the residential well where 1,2-dichloropropane was detected in a groundwater sample at a concentration that exceeded the Federal Maximum Contaminant Level (MCL). As shown on Figure 4.8, VAS boreholes VAS-120 will be installed east of VAS-114 to help delineate the lateral and vertical extent of the contaminant plume.

Historic data collected by the USGS in the early 1990s indicate the presence of a low concentration bromide plume south of the Site. Bromide is conservative with respect to groundwater transport, meaning that it dissolves readily in groundwater and is only slightly attenuated during transport via groundwater. Therefore, the extent of the historic bromide plume likely represents the maximum extent of groundwater impact from the Site. It should be noted that a VOC or SVOC plume has never been detected in this area; however, there is a potential for Site-related contaminants to migrate to this portion of the aquifer. VAS boreholes VAS-105 and VAS-106 will be installed adjacent to existing monitoring wells WT105A and WT106A, respectively. The results of groundwater samples collected from these VAS boreholes will be used to delineate the southern extent of the contaminant plume and to evaluate the existing monitoring well network. If the results from the shallow and deep Phase I Groundwater Investigation VAS boreholes indicate that the limit of the contaminant plume has not been defined, additional VAS boreholes and monitoring wells will be installed during subsequent investigative phases at locations further downgradient of these wells and/or at deeper intervals.

The horizontal and vertical location of the VAS boreholes will be surveyed after each phase of VAS is complete.

4.4.5 INTERIM GROUNDWATER MONITORING PROGRAM

Section II, Paragraph 5.1 of the SOW states that the PSDs "will submit a groundwater monitoring plan as part of the RD Work Plan, which will address the frequency of sampling, the wells to be sampled, and laboratory analyses to be performed". The SOW also requires that the wells be segregated into wells for detection monitoring and wells for compliance monitoring. Paragraph 5.1.4 further states that all groundwater wells associated with the Site shall be monitored for 10 years, but that an alternate schedule may be used if approved by USEPA.

Since the SOW requires further investigation and characterization of groundwater at the Site, and additional monitoring wells will be installed over time, CRA proposes to implement an Interim Groundwater Monitoring Program commencing 90 days after the Baseline Groundwater Sampling. CRA will present the results of the Baseline Groundwater Sampling and the first rounds of VAS in the Phase I Groundwater Investigation Report, and will modify the scope of the Interim Groundwater Monitoring Program as additional wells are installed on Site. The Interim Groundwater Monitoring Program will include synoptic groundwater elevation monitoring and water quality sampling of select wells on a quarterly basis for 2 years. The primary goal of the Interim Groundwater Monitoring Program will be to monitor the limits of groundwater contamination for any plume expansion. The list of proposed monitoring wells to be included in the Interim Groundwater Monitoring Program will be provided in the Phase I Groundwater Investigation Report. As new monitoring wells are installed they will be incorporated into the Interim Groundwater Monitoring Program, as appropriate. The parameter list for the Interim Groundwater Monitoring Program is provided in Table 4.3. The results of the Interim Groundwater Monitoring Program will be provided to the USEPA on an annual basis.

4.4.6 NEW MONITORING WELLS

Based on the results of the VAS, CRA will design an appropriate monitoring well network. Conceptually, detection monitoring wells (to monitor the portion of the plume where contamination is detected) will be installed at the depths/locations where the highest concentrations of contaminants are encountered. Sentinel monitoring wells will be installed in areas where little or no groundwater contamination exists to monitor for potential plume expansion.

CRA's conventional monitoring well installation techniques will be used to install the monitoring wells, as described in the FSP (Appendix A). CRA will retain a drilling subcontractor licensed in the state of Indiana to complete the work. The shallow and intermediate depth monitoring wells (up to 100 ft bgs) will be installed using the hollow stem auger drilling technique. Deeper installations (100 to 200 ft bgs) will require drilling equipment capable of working at greater depths, such as rotosonic drilling equipment.

The new monitoring wells will be surveyed for horizontal and vertical location after being installed, as described in the FSP (Appendix A).

Investigative derived wastes will include soil cuttings from the drilling activities, decontamination water, and groundwater purged from the monitoring wells during well development and sampling. Investigation derived waste will be managed as outlined in Section 7.0 of the FSP (Appendix A).

4.4.7 GROUNDWATER INVESTIGATION REPORTING

The groundwater investigation will be completed in phases, as described above. As such a series of work plans and reports will be submitted to document the progress of the groundwater investigation and the rationale for further work.

The Phase I Groundwater Investigation Report will present the results of the Baseline Groundwater Monitoring and the VAS results. The report will include data tables, groundwater elevation contour maps, and a comparison of the data to the screening criteria provided in Table 4.3. This report will compare the results to historical data, identify any data gaps, and outline the scope of work for the second phase of groundwater investigation. This report will also identify the list of wells to be included in the Interim Groundwater Monitoring Program, as described in Section 4.4 of this RD Work Plan.

Similar data reports will also be submitted to USEPA following the Phase II Groundwater Investigation and, if necessary, the Phase III Groundwater Investigation. Each report will present data tables, figures, and an interpretation of the data, plus recommendations for future work, if any.

5.0 REMEDIAL DESIGN PHASES

5.1 PRE-DESIGN INVESTIGATION RESULTS

The results of the Pre-Design Investigation will be submitted in several documents as the phased investigations are completed, as described in Section 4 of this RD Work Plan.

Following receipt of USEPA approval of the final pre-design investigation submittal, CRA will schedule a Design Meeting with the PSDs, USEPA, and IDEM as required by the SOW. The purpose of the meeting will be to review the results of the pre-design investigation with USEPA and IDEM, and discuss the key components of the RD, anticipated issues, and schedule.

5.2 PRELIMINARY (60%) DESIGN

In accordance with Section III, Task 2, Item 2.2 of the SOW, the Preliminary (60%) Design submittal will discuss the results of the Pre-Design Investigation and will present preliminary plans, drawings, and calculations, as appropriate, for the proposed RA. The submittal will include design assumptions, performance criteria, a summary of the anticipated operation, monitoring, and maintenance requirements, and a draft contingency plan. CRA will provide a preliminary outline of the specification sections required for the RA construction, as well as an outline of anticipated permit requirements. CRA will also submit a preliminary construction schedule as required by the SOW.

5.3 PRE-FINAL (90%) DESIGN

In accordance with Section III, Task 2, Item 2.3 of the SOW, the Pre-Final (90%) Design will address USEPA's and IDEM's comments on the Preliminary Design, and will provide the following additional information:

- Draft Performance Standard Verification Plan;
- Draft Construction Quality Assurance Plan;
- Draft Health and Safety Plan;
- Draft Field Sampling Plan, if required;
- Draft Contingency Plan; and
- Draft Operation and Maintenance Plan.

5.4 FINAL (100%) DESIGN

In accordance with Section III, Task 2, Item 2.4 of the SOW, the Final (100%) Design will address USEPA's and IDEM's comments on the Pre-Final Design, and will provide the following additional information:

- Final specifications and project drawings;
- Capital and Operation and Maintenance Cost Estimate for the RA; and
- Final Project Schedule.

6.0 SCHEDULE

The preliminary project schedule illustrating expected progress through the RD Work Plan is presented on Figure 6.1. This schedule is consistent with the schedule submitted to USEPA and IDEM each month with the Progress Report.

The schedule start is based on agency approval of the RD Work Plan. The first key task is to complete Phase I of the Pre-Design Investigation. The duration of the investigation will be greatly affected by the PSDs' ability to secure access agreements for private properties where groundwater, soil gas, or soil samples will be collected or test pits will be installed.

A 60-day allowance for agency review of submittals is provided in the schedule provided on Figure 6.1. The actual agency review time may be more or less than 60 days and could be different for each phase of the pre-design investigation. The schedule for the landfill cover may therefore diverge from the groundwater monitoring schedule.

As previously discussed in this Work Plan, the PSDs submitted the RD Work Plan for Residential Well Abandonment and Municipal Water Supply under separate cover so that the review and approval of that portion of the work can proceed as soon as possible. The PSDs believe that it is in the best interest of the public to allow the provision of municipal water to residents to proceed as prescribed in the CD and SOW as soon as possible.

7.0 PROJECT MANAGEMENT

This section describes the project organization and responsibilities of the project team.

7.1 PROJECT ORGANIZATION

The organizational structure of the project is shown on Figure 7.1 and is described below.

PSDs

The PSDs are the represented by the Himco Site Trust. The Himco Site Trust is managed by Bayer Healthcare, LLC.

PSDs' Project Coordinator – Mr. Gary Toczylowski, Bayer HealthCare

The PSDs have identified Mr. Gary Toczylowski of Bayer HealthCare as their Project Coordinator. As Project Coordinator, Mr. Toczylowski has overall responsibility for the implementation of the RD/RA and oversees the work of the Supervising Contractor.

The PSDs have identified Mr. Tom Lenz of Bayer HealthCare as their Alternate Project Coordinator. Responsibilities are the same as shown above as delegated by the Project Coordinator.

Supervising Contractor – Conestoga-Rovers & Associates

The PSDs retained CRA to act as Supervising Contractor for the RD/RA. CRA reports to the PSDs' Project Coordinator, Mr. Gary Toczylowski. CRA's work for the RD will include, among other things, preparation of work plans, implementation and oversight of the work, reporting, and design of the remedy. Subcontractors will be selected by CRA to perform specific tasks such as drilling, surveying, laboratory analyses, etc. Subcontractors will be subject to approval by the PSDs' Project Coordinator prior to working on the Site.

7.2 RESPONSIBILITIES OF PROJECT TEAM

The key CRA project personnel and their responsibilities are as follows:

Project Manager – Alan Van Norman

- Management of CRA project team.
- Meetings with Himco Site Trust representatives and USEPA.
- Coordination of technical task leaders.
- Oversight of all project activities.
- Data evaluation.
- Preparation and review of deliverables.
- Technical representation of project activities.
- Selection of subcontractors.

Technical Task Leaders

The CRA technical task leaders are responsible for the task-specific aspects of the RD/RA. The task leaders report to the project manager. The task leaders are as follows:

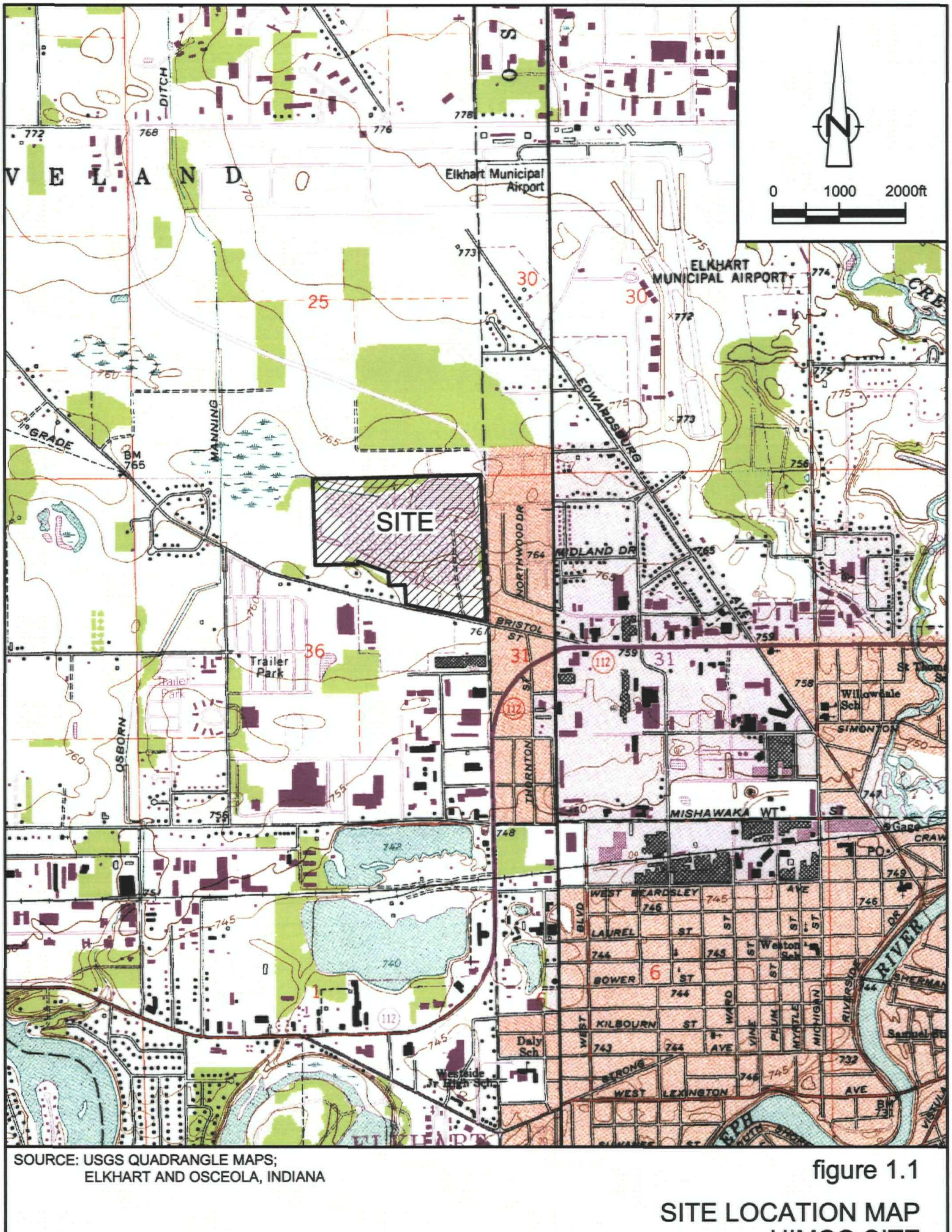
Health and Safety	Bill Doyle
Landfill Engineering	Douglas Gatrell, P.E.
Geology/Hydrogeology	Alan Deal
Analytical Chemistry/Quality Assurance	Steve Day
Database Management	Tim Harris

Field Staff

CRA field staff will be responsible for performing all field activities such as sampling and mapping, and for overseeing the activities of the subcontractors. Alan Deal and Doug Gatrell will coordinate the field staff activities.

8.0 COMMUNITY RELATIONS

In accordance with Section XXX of the CD, the development and implementation of a community relations plan is the responsibility of USEPA. USEPA issued a Community Involvement Plan (CIP) in January 2008 that summarized USEPA's interviews with residents and outlined ways that USEPA would address the issues, concerns, and questions that the public has expressed about the Site. The CIP did not outline a specific role for the PSDs in community relations activities. The PSDs will support USEPA and IDEM as requested in providing information regarding the work to the public, or other reasonable requests. The PSDs will advise USEPA and IDEM of all community relations activities initiated by the PSDs and will invite USEPA and IDEM to participate in the planning and development of such activities as appropriate.



SOURCE: USGS QUADRANGLE MAPS;
ELKHART AND OSCEOLA, INDIANA

figure 1.1

SITE LOCATION MAP
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA006 OCT 01/2008

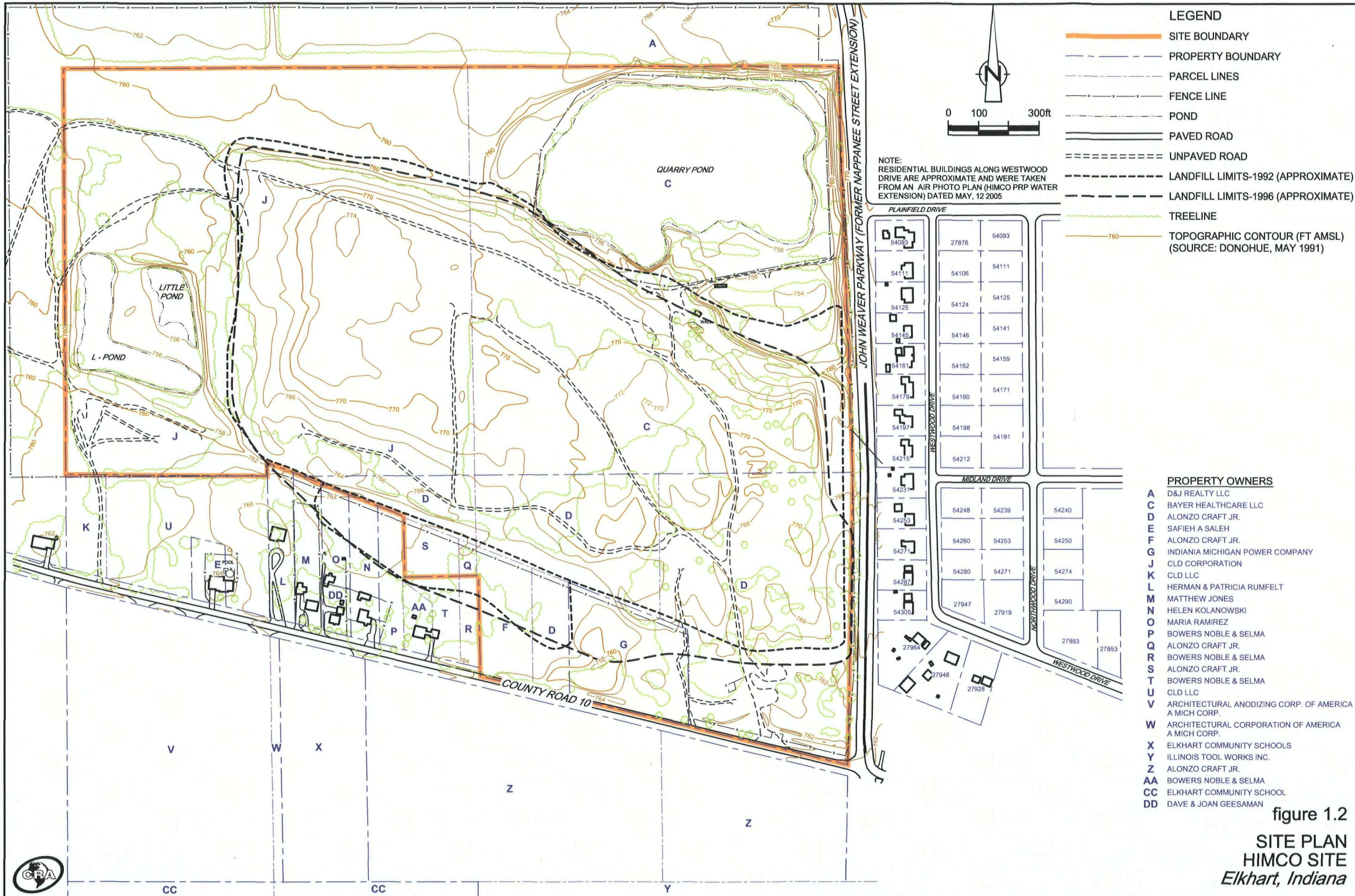
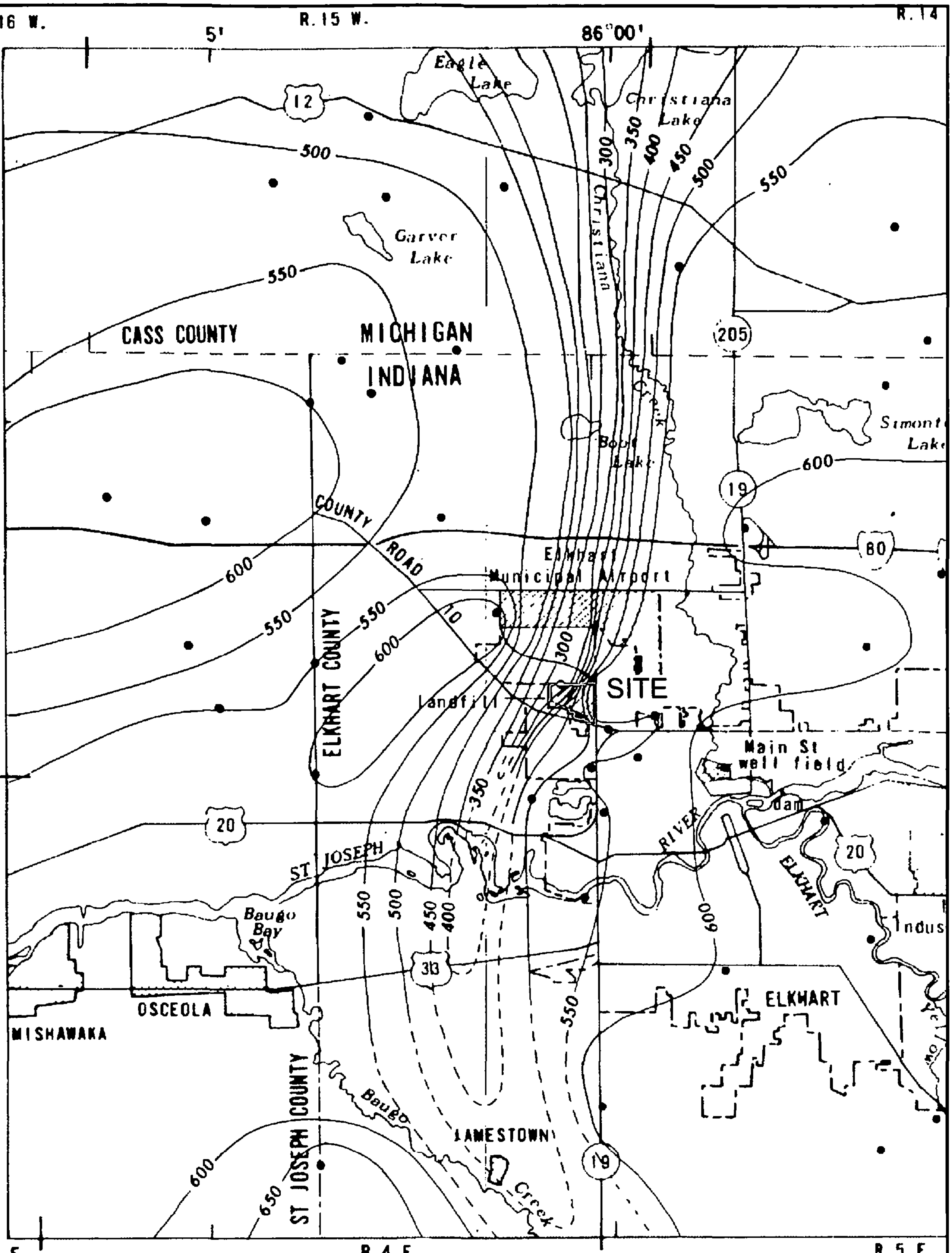


figure 1.2

SITE PLAN
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA007 OCT 01/2008



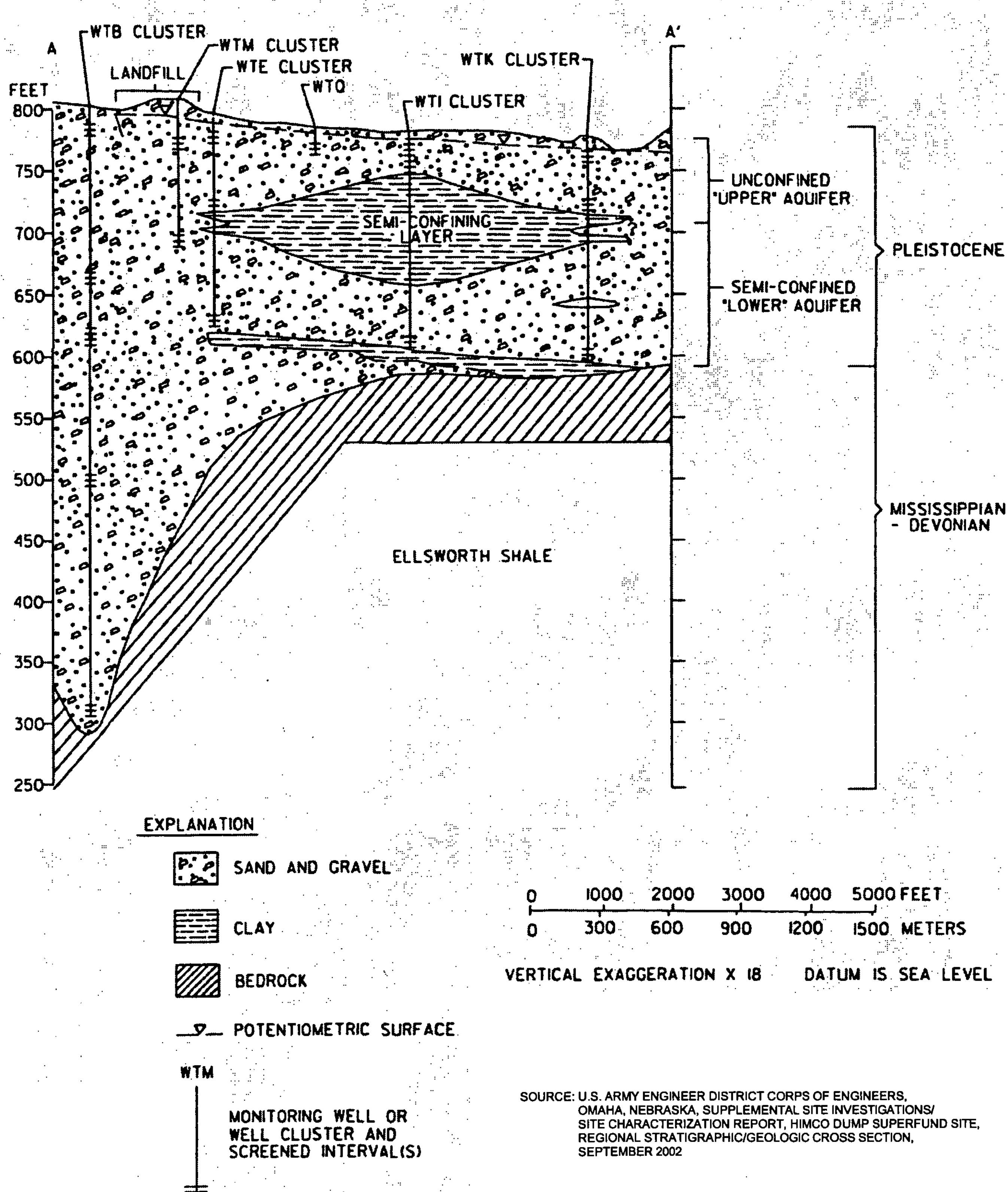
BASE FROM U.S. GEOLOGICAL SURVEY ELKHART 1:24,000, 1961, REVISED 1981, BRISTOL 1:24,000, 1961, REVISED 1981, OSCEOLA, 1:24:000, REVISED 1986

figure 2.1

BEDROCK TOPOGRAPHY CONTOUR MAP
HIMCO SITE
Elkhart, Indiana

SOURCE:
GROUNDWATER LEVELS, FLOW AND QUALITY IN NORTHWESTERN ELKHART COUNTY INDIANA, 1980-89 (DUWELUIS AND SILCOX, 1991).

39611-00(002)GN-WA009 OCT 01/2008

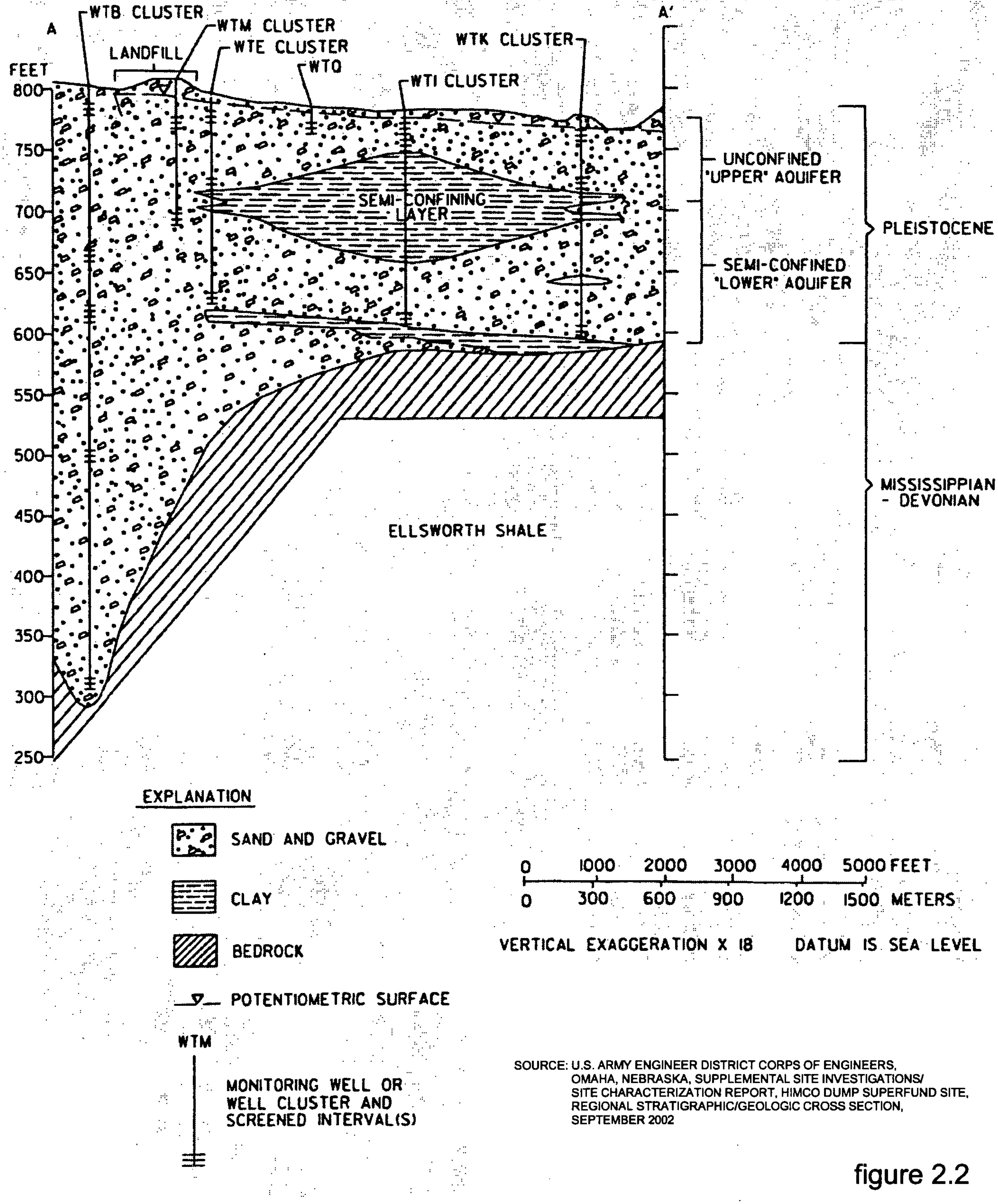


SOURCE: U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS, OMAHA, NEBRASKA, SUPPLEMENTAL SITE INVESTIGATIONS/ SITE CHARACTERIZATION REPORT, HIMCO DUMP SUPERFUND SITE, REGIONAL STRATIGRAPHIC/GEOLOGIC CROSS SECTION, SEPTEMBER 2002

figure 2.2

REGIONAL STRATIGRAPHIC/GEOLOGIC CROSS-SECTION
HIMCO SITE
Elkhart, Indiana

CRA



SOURCE: U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS, OMAHA, NEBRASKA, SUPPLEMENTAL SITE INVESTIGATIONS/ SITE CHARACTERIZATION REPORT, HIMCO DUMP SUPERFUND SITE, REGIONAL STRATIGRAPHIC/GEOLOGIC CROSS SECTION, SEPTEMBER 2002

figure 2.2

REGIONAL STRATIGRAPHIC/GEOLOGIC CROSS-SECTION
HIMCO SITE
Elkhart, Indiana

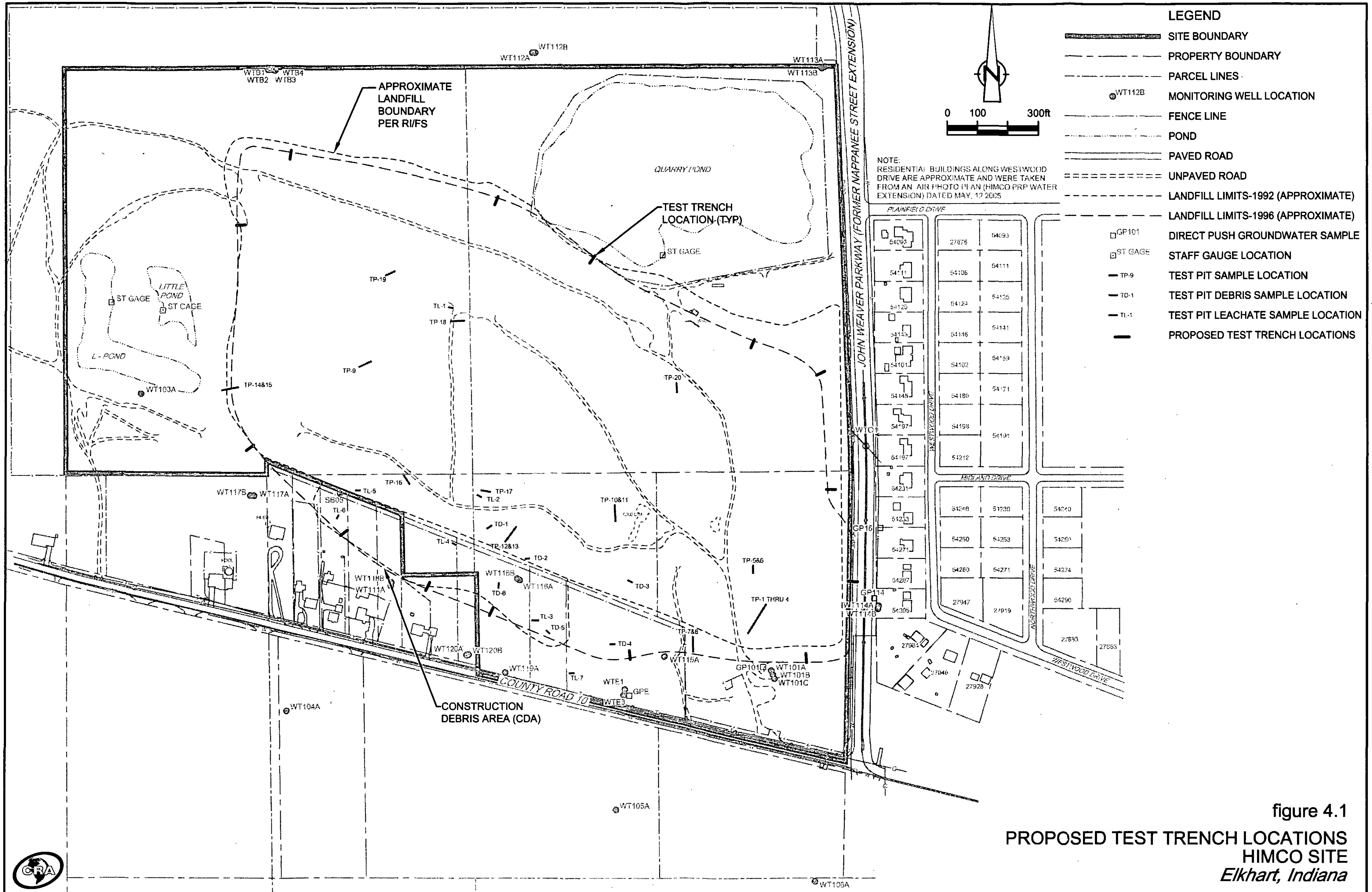


figure 4.1

PROPOSED TEST TRENCH LOCATIONS
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA011 OCT 01/2008

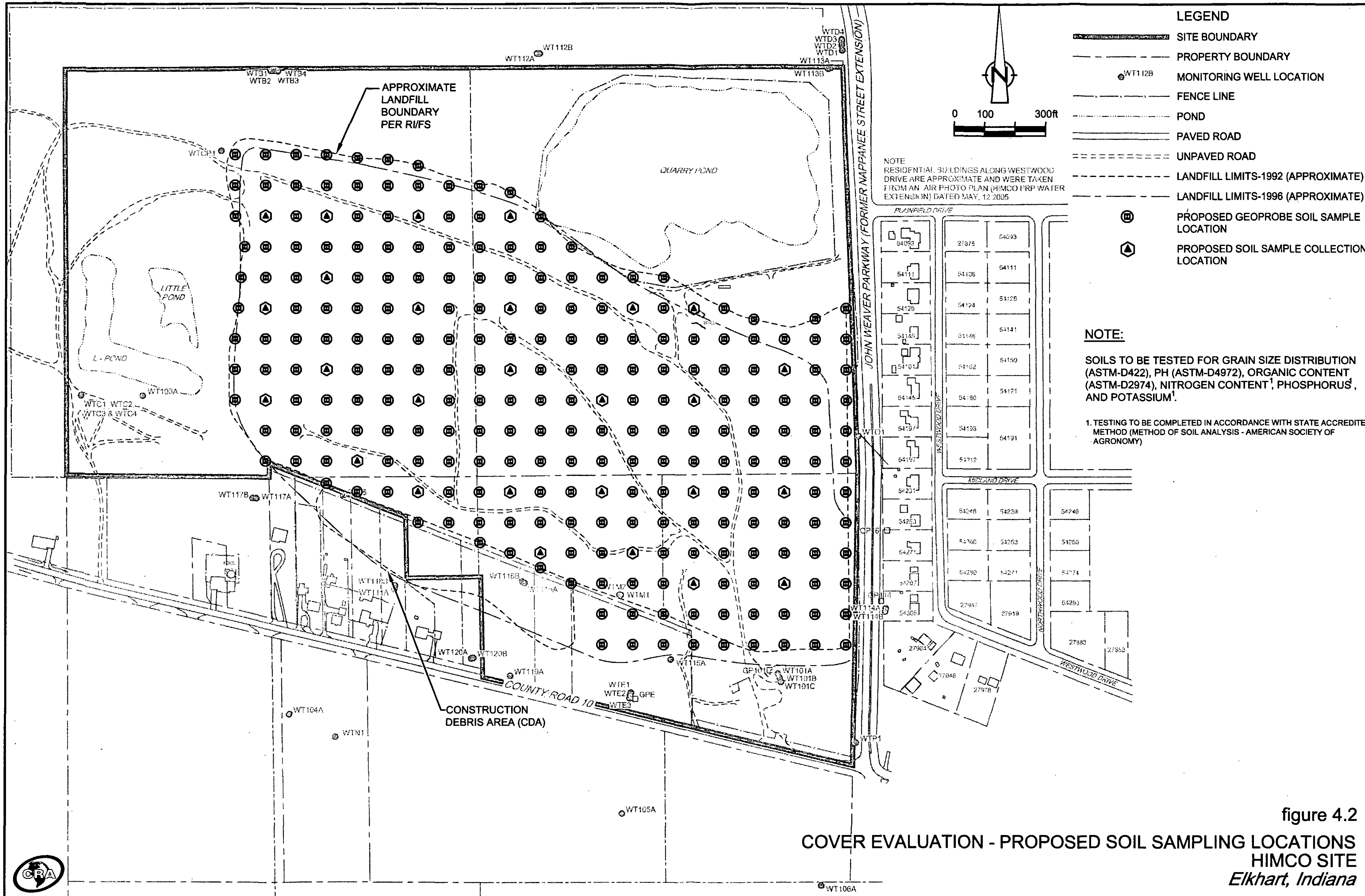


figure 4.2
COVER EVALUATION - PROPOSED SOIL SAMPLING LOCATIONS
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA012 OCT 01/2008

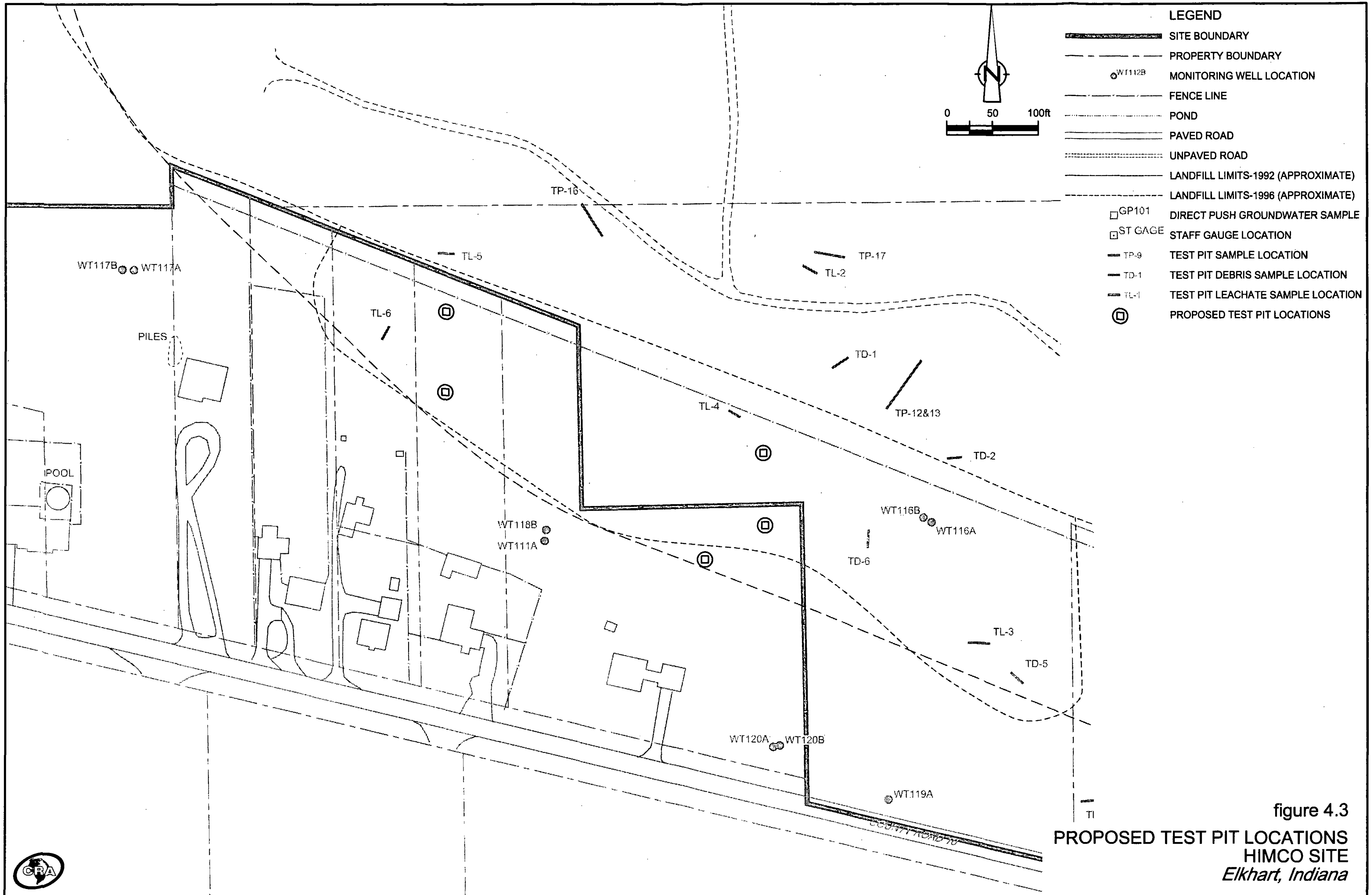


figure 4.3

PROPOSED TEST PIT LOCATIONS
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA013 OCT 01/2008

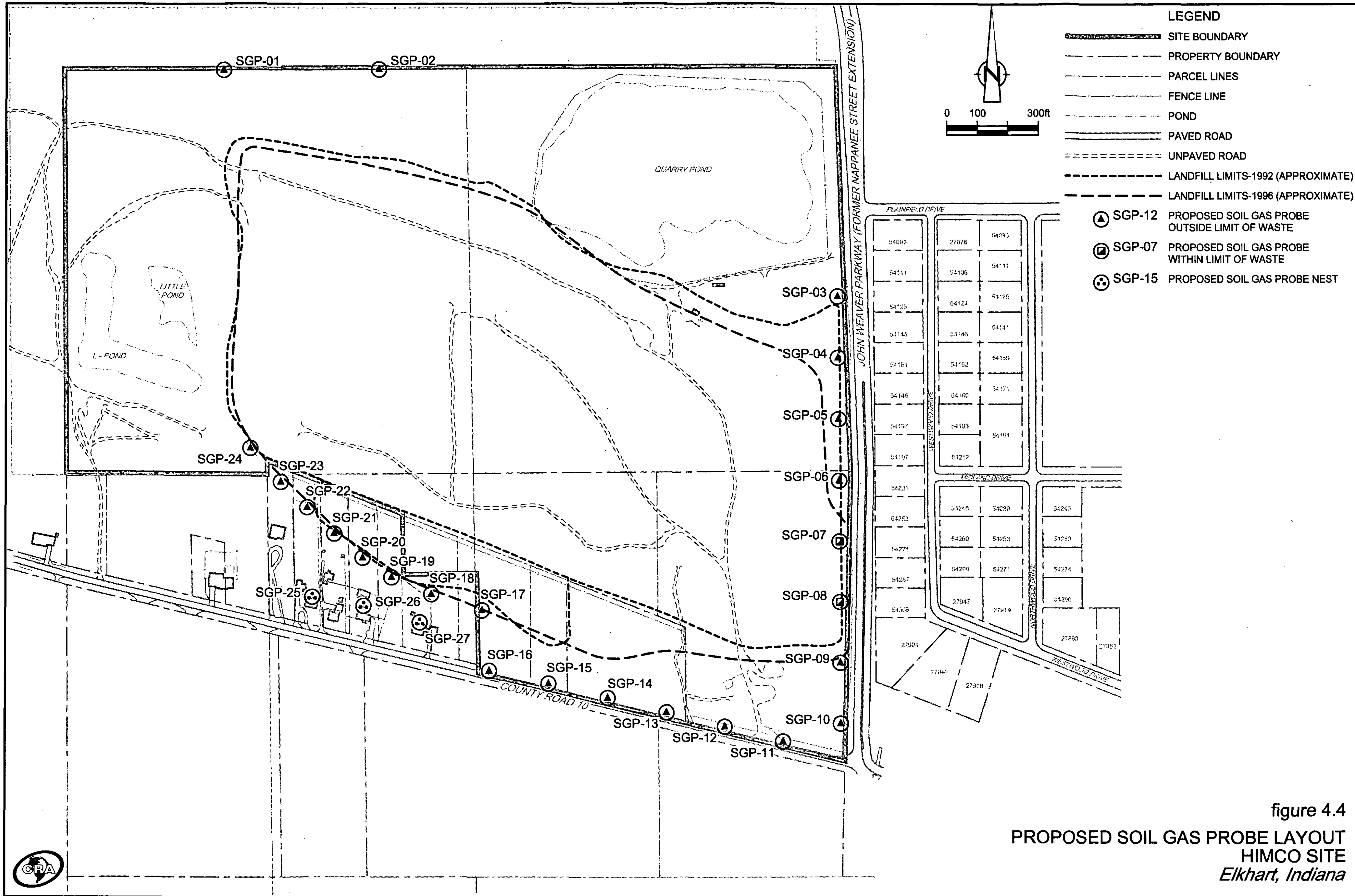


figure 4.4

PROPOSED SOIL GAS PROBE LAYOUT
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA002 OCT 01/2008

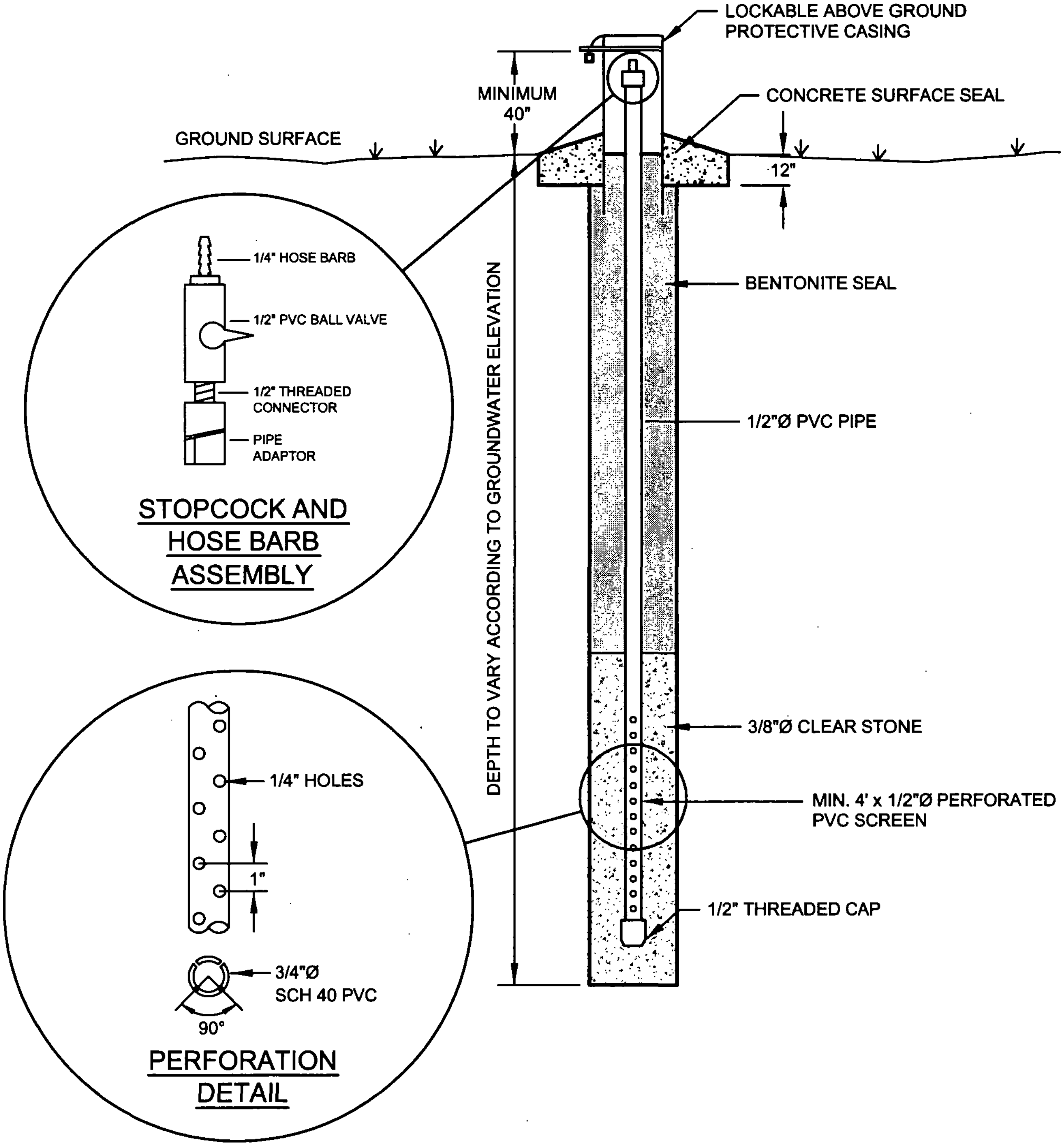


figure 4.5

TYPICAL SOIL GAS PROBE
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA003 OCT 01/2008

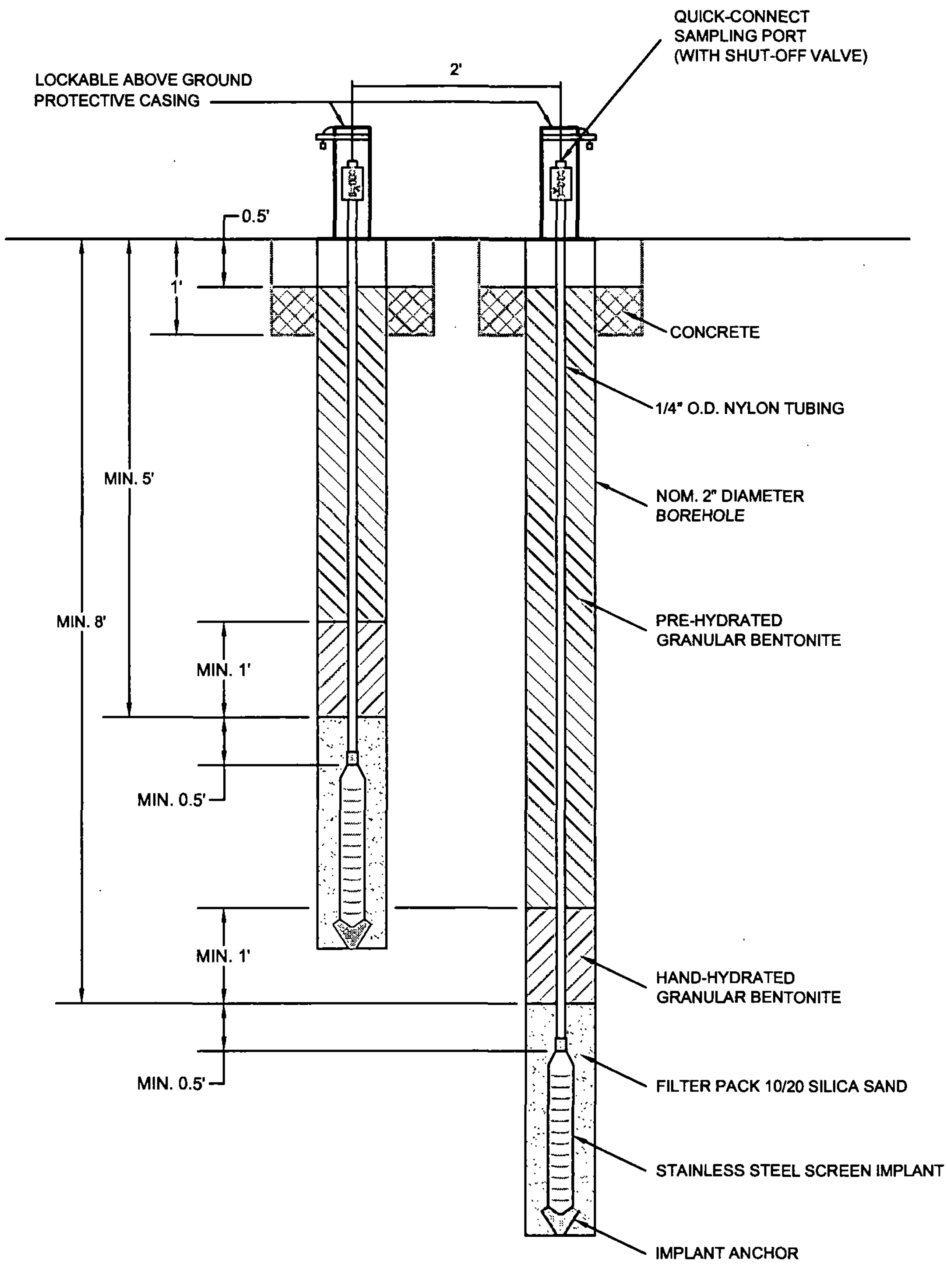


figure 4.6

TYPICAL SOIL GAS PROBE NEST
HIMCO SITE
Elkhart, Indiana

CRA

39611-00(002)GN-WA004 OCT 01/2008

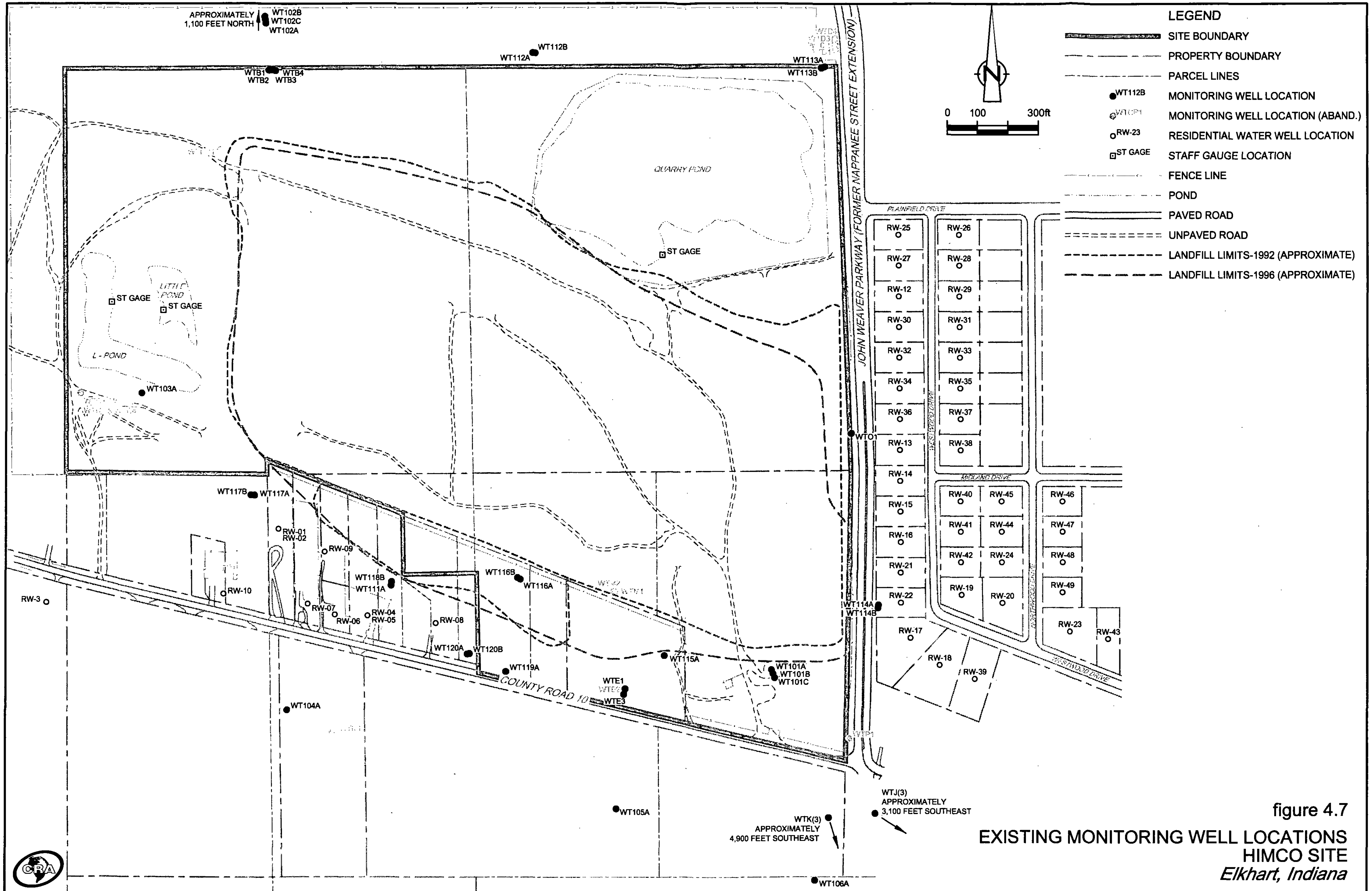


figure 4.7

EXISTING MONITORING WELL LOCATIONS
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA010 OCT 01/2008

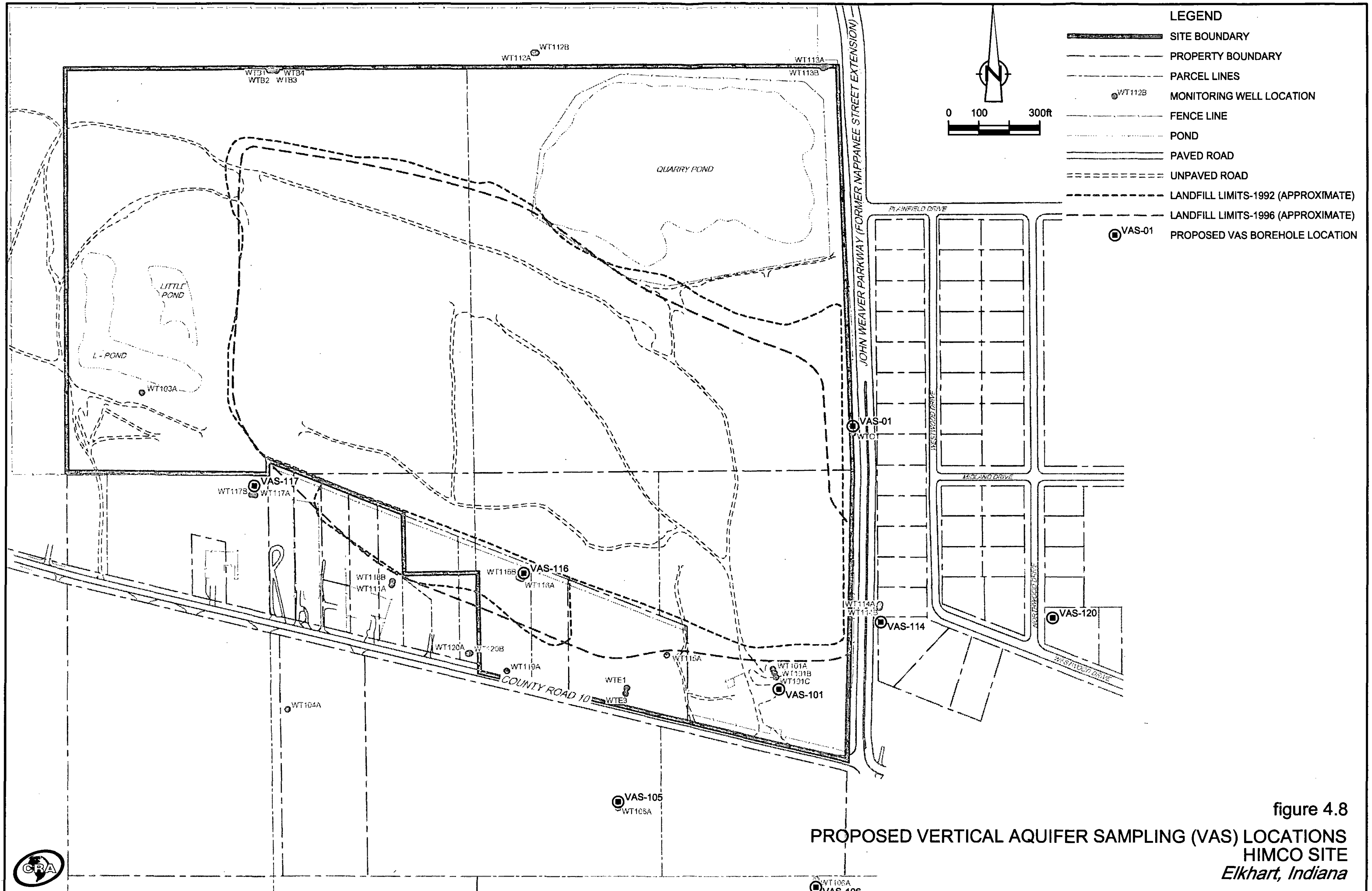
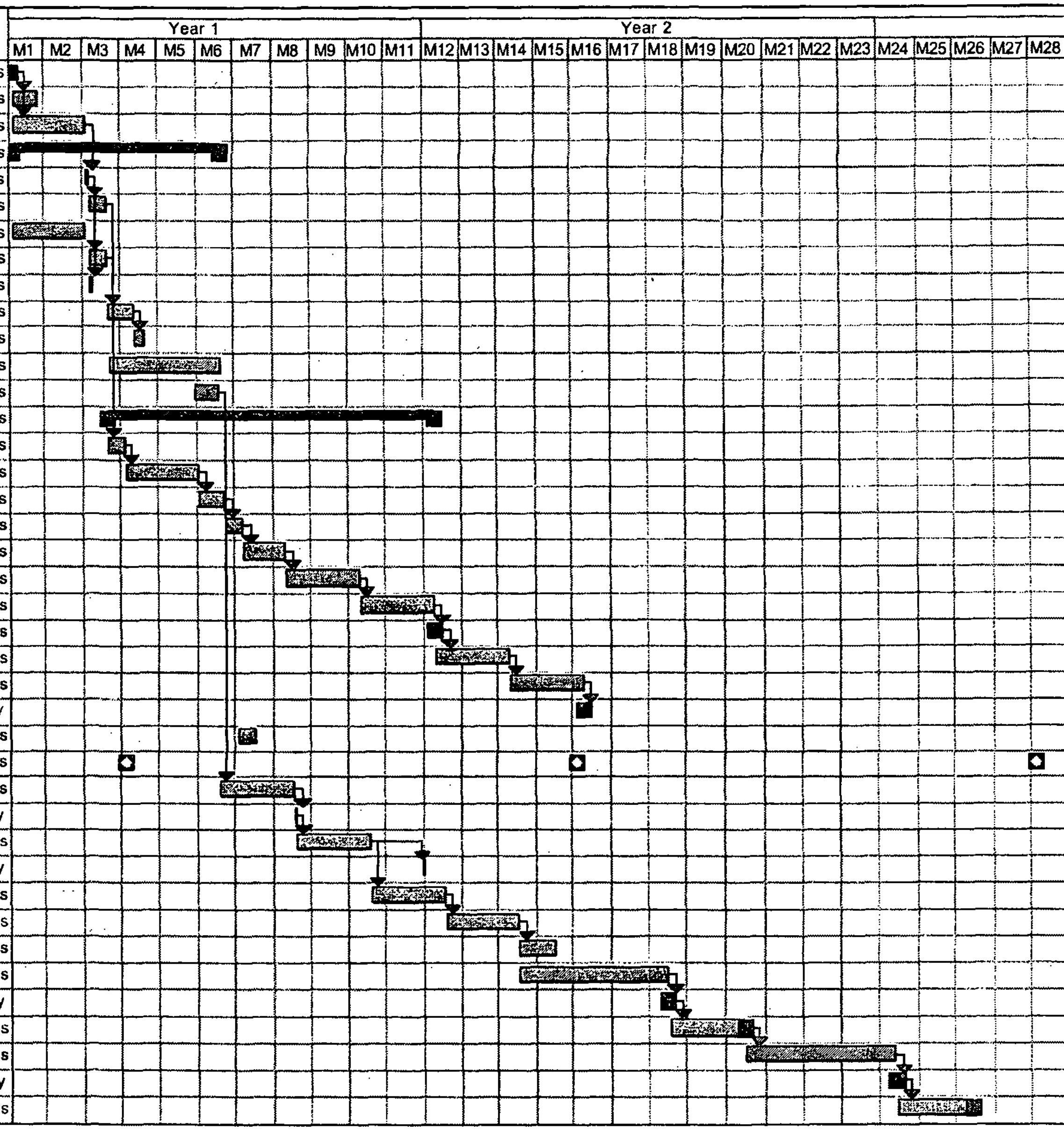


figure 4.8

PROPOSED VERTICAL AQUIFER SAMPLING (VAS) LOCATIONS
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA001 OCT 01/2008

Task No.	Task Description	Duration (calendar)
1.0	USEPA Approval of RD Work Plan	0 days
2.0	Historic Data Compilation	20 days
3.0	Access Agreements	60 days
4.0	*Pre-design Investigation*	*168 days*
4.1	Site Reconnaissance	2 days
4.2	Well/Probe Repairs and Well Redevelopment	14 days
4.3	Subcontractor Procurement	60 days
4.4	Utility Locates	14 days
4.5	Survey	3 days
4.6	Landfill Cover Investigation	21 days
4.7	Soil Gas Probe Installation/Sampling	10 days
4.8	Sample Analysis/QA/QC	91 days
4.9	Data Review	21 days
5.0	Phase I Groundwater Investigation	264 days
5.1	Baseline Groundwater Sampling	14 days
5.2	Sample Analysis/QA/QC	60 days
5.3	Data Review	21 days
5.4	Shallow Vertical Aquifer Sampling (VAS)	14 days
5.5	Deep VAS	35 days
5.6	Sample Analysis/QA/QC	60 days
5.7	Data Review/Reporting	60 days
6.0	Phase I Groundwater Investigation Report	0 days
7.0	USEPA Review of Phase I Groundwater Investigation Report	60 days
7.1	Response to USEPA Comments	60 days
7.2	USEPA Approval of Phase I Groundwater Investigation Report	1 day
8.0	Interim Groundwater Monitoring Program	14 days
8.1	Annual Groundwater Reporting	731 days
9.0	Preliminary Remedial Design	60 days
9.1	Submit Preliminary (60%) Design	1 day
10.0	USEPA Review of Preliminary (60%) Design	60 days
11.0	Design Meeting	1 day
12.0	Submit Pre-final Design	60 days
13.0	USEPA Review of Pre-final Design	60 days
14.0	Submit Final Design	30 days
15.0	Phase II Groundwater Investigation	120 days
15.1	Phase II Groundwater Investigation Report	1 day
15.2	USEPA Review/Approval of Phase II Groundwater Investigation Report	60 days
16.0	Phase III Groundwater Investigation (if needed)	120 days
16.1	Phase III Groundwater Investigation Report	1 day
16.2	USEPA Review/Approval of Phase III Groundwater Investigation Report	60 days



Project: 39611-Fig. 6.1 Himco
Date: Fri 1/25/08

Task | Milestone | Summary | Rolled up Milestone

FIGURE 6.1
REMEDIAL DESIGN SCHEDULE
HIMCO SITE
ELKHART, IN

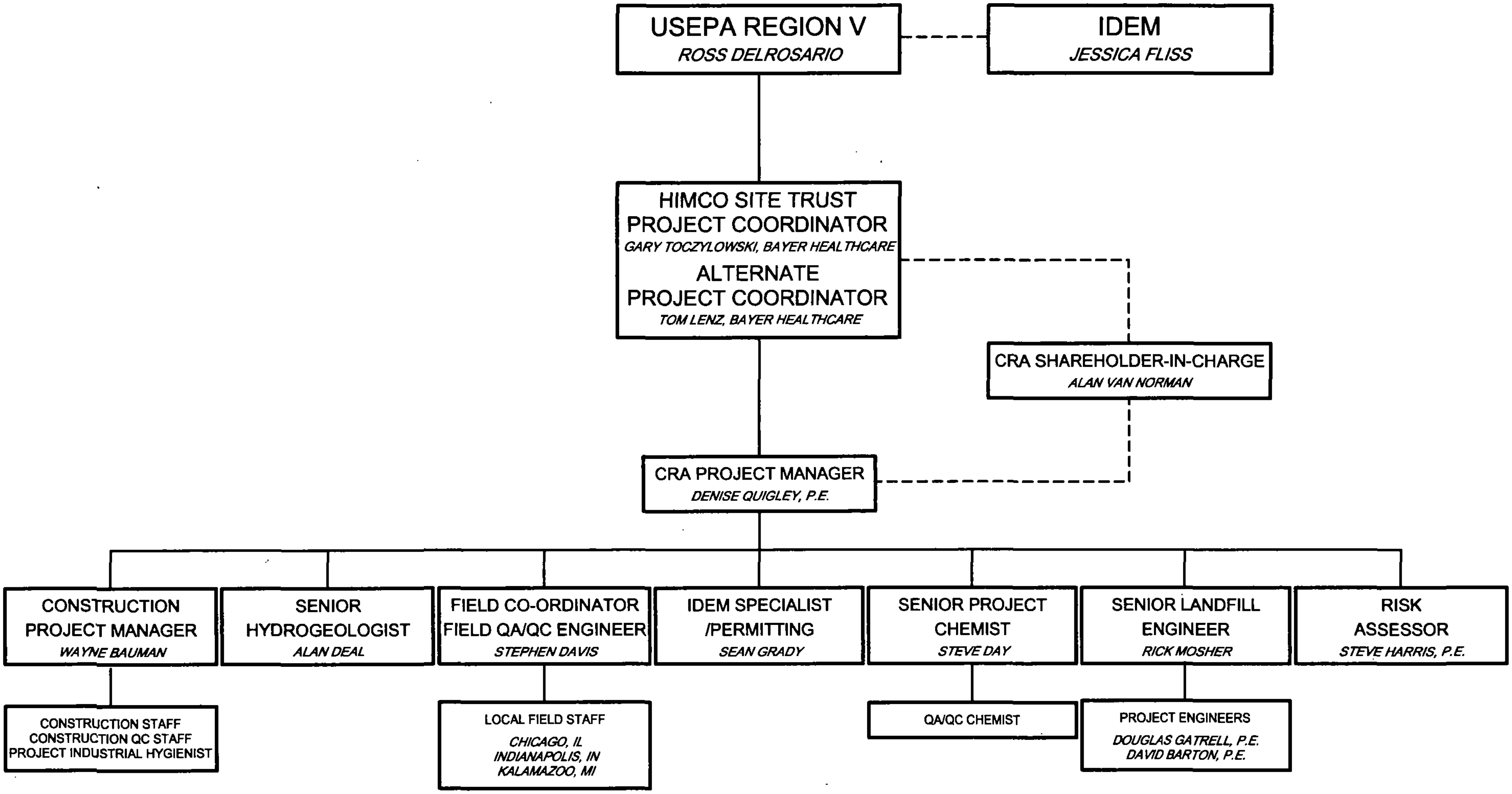


figure 7.1

PROJECT ORGANIZATION CHART
HIMCO SITE
Elkhart, Indiana

39611-00(002)GN-WA008 OCT 01/2008

TABLE 4.1

MONITORING WELL DETAILS
HIMCO SITE
ELKHART, INDIANA

WELL ID	*Status*	*Installation Date*	*Screen Length (ft)*	*Material*	*Casing Diameter (inches)*	*Installed Depth (ft)*	*Well Elevation (ft MSL)*	*Depth Designation*	*Northing*	*Easting*
WTB1	Existing	06/10/1977	6.00	PVC	5	473.0	763.65	Deep	405953.343	1533596.81
WTB2	Existing	03/11/1977	10.00	Black Steel	2	11.9	763.18	Shallow	405959.096	1533597.416
WTB3	Existing	17/10/1977	10.00	PVC	5	135.0	763.28	Deep	405968.153	1533597.416
WTB4	Existing	07/10/1977	5.00	PVC	5	173.0	762.33	Deep	405975.91	1533595.28
WTC1	Abandoned	04/10/1977	5.00	PVC	5	342.0	n/a	Deep	405337.434	1532537.321
WTC2	Abandoned	03/11/1977	10.00	--	2	12.5	n/a	Shallow	405337.434	1532537.321
WTC3	Abandoned	05/10/1977	5.00	PVC	5	197.0	n/a	Deep	405337.434	1532537.321
WTC4	Abandoned	05/10/1977	10.00	PVC	5	130.0	n/a	Deep	405337.434	1532537.321
WTCP1	Abandoned	--	--	--	--	--	n/a	Shallow	405792.81	1533336.252
WTD1	Abandoned	13/10/1977	10.00	Black Steel	2	19.3	n/a	Shallow	407825.379	1533664.513
WTD2	Abandoned	03/10/1977	5.00	PVC	5	176.0	n/a	Deep	407823.8	1533682.282
WTD3	Abandoned	03/10/1977	10.00	PVC	5	90.0	n/a	Deep	407823.405	1533694.128
WTD4	Abandoned	27/09/1977	3.00	--	2	29.9	n/a	Shallow	407823.694	1533700.00
WTE1	Existing	11/10/1977	10.00	PVC	5	81.0	765.75	Deep	407131.635	1531566.581
WTE2	Abandoned	03/11/1977	10.00	Black Steel	2	17.4	n/a	Shallow	407127.987	1531555.876
WTE3	Existing	11/10/1977	5.00	PVC	5	176.0	765.47	Deep	407126.915	1531548.261
WTF1	Abandoned	13/10/1977	10.00	PVC	2	31.5	n/a	Shallow	408918.578	1530899.674
WTF2	Abandoned	12/10/1977	5.00	PVC	5	155.0	n/a	Deep	408918.578	1530899.674
WTF3	Abandoned	03/11/1977	10.00	--	2	14.7	n/a	Shallow	408918.578	1530899.674
WTF4	Abandoned	28/09/1977	2.50	--	2	23.5	n/a	Shallow	408918.578	1530899.674
WTF5	Abandoned	11/10/1977	10.00	PVC	5	198.0	n/a	Deep	408918.578	1530899.674
WTG1	Existing	17/10/1977	5.00	PVC	5	52.0	763.23	Intermediate	411195.0202	1531578.281
WTG2	Abandoned	02/11/1977	10.00	--	2	16.3	n/a	Shallow	411195.0202	1531578.281
WTG3	Exisiting	17/10/1977	10.00	PVC	5	172.0	763.37	Deep	411195.0202	1531578.281
WTI1	Abandoned	13/10/1977	5.00	PVC	5	168.0	n/a	Deep	407553.594	1528753.457
WTI2	Abandoned	03/11/1977	10.00	Black Steel	2	15.4	n/a	Shallow	407553.594	1528753.457
WTI3	Abandoned	13/10/1977	5.00	PVC	5	37.0	n/a	Intermediate	407553.594	1528753.457
WTI4	Abandoned	28/09/1977	2.50	--	2	24.2	n/a	Shallow	407553.594	1528753.457
WTJ1	Existing	12/10/1977	5.00	PVC	5	40.0	--	Intermediate	410570.204	1529492.276
WTJ2	Existing	02/11/1977	10.00	Black Steel	2	17.8	--	Shallow	410570.204	1529492.276
WTJ3	Existing	12/10/1977	5.00	PVC	5	154.0	--	Deep	410570.204	1529492.276
WTK1	Existing	13/10/1977	5.00	PVC	5	62.0	--	Intermediate	409348.3593	1526493.528
WTK2	Existing	02/11/1977	10.00	Black Steel	2	14.6	--	Shallow	409348.3593	1526493.528
WTK3	Existing	13/10/1977	5.00	PVC	5	185.0	--	Deep	409348.3593	1526493.528
WTM1	Abandoned	03/05/1979	5.00	Galvanized Steel	2	103.6	n/a	Deep	407098.276	1531886.152
WTM2	Abandoned	02/05/1979	5.00	PVC	2	25.2	n/a	Shallow	407094.31	1531887.106
WTN1	Abandoned	30/04/1979	5.00	PVC	2	30.0	n/a	Shallow	406167.56	1531421.732
WTO1	Existing	01/05/1979	5.00	PVC	2	30.0	762.83	Shallow	407876.93	1532407.14
WTP1	Abandoned	03/05/1979	5.00	PVC	2	25.0	n/a	Shallow	407871.005	1531404.608
WTQ1	Abandoned	26/04/1979	5.00	PVC	2	25.0	n/a	Shallow	407268.737	1529865.486
WT101A	Existing	12/11/1990	10.00	Stainless Steel	2	16.3	764.34	Shallow	407616.935	1531629.872
WT101B	Existing	14/12/1990	5.00	Stainless Steel	2	98.0	764.23	Deep	407621.827	1531617
WT101C	Existing	12/12/1990	5.00	Stainless Steel	2	165.0	764.11	Deep	407627.48	1531603.13

TABLE 4.1

MONITORING WELL DETAILS
HIMCO SITE
ELKHART, INDIANA

WELL ID	*Status*	*Installation Date*	*Screen Length (ft)*	*Material*	*Casing Diameter (inches)*	*Installed Depth (ft)*	*Well Elevation (ft MSL)*	*Depth Designation*	*Northing*	*Easting*
WT102A	Existing	10/11/1990	10.00	Stainless Steel	2	16.0	769.09	Shallow	405943.744	1534850.603
WT102B	Existing	02/12/1990	5.00	Stainless Steel	2	65.4	768.82	Intermediate	405939.849	1534872.807
WT102C	Existing	01/12/1990	5.00	Stainless Steel	2	159.5	769.2	Deep	405941.969	1534862.84
WT103A	Existing	11/11/1990	10.00	Stainless Steel	2	16.0	762.61	Shallow	405538.04	1532537.59
WT104A	Existing	12/11/1990	10.00	Stainless Steel	2	16.3	765.29	Shallow	406017.3	1531495.73
WT105A	Existing	10/11/1990	10.00	Stainless Steel	2	16.0	762.58	Shallow	407103.043	1531172.513
WT106A	Existing	09/11/1990	10.00	Stainless Steel	2	16.3	761.5	Shallow	407761.032	1530938.243
WT111A	Existing	10/09/1991	10.00	Stainless Steel	2	20.0	766.45	Shallow	406359.407	1531905.516
WT112A	Existing	23/08/1995	10.00	PVC	2	15.4	765.9	Shallow	406825.038	1533653.174
WT112B	Existing	23/08/1995	5.00	PVC	2	59.4	766.09	Intermediate	406834.072	1533653.078
WT113A	Existing	10/08/1995	10.00	PVC	2	21.7	771.85	Shallow	407789.066	1533608.616
WT113B	Existing	10/08/1995	5.00	PVC	2	67.2	772.06	Intermediate	407779.02	1533604.429
WT114A	Existing	21/08/1995	10.00	PVC	2	22.0	769.19	Shallow	407997.476	1531843.961
WT114B	Existing	22/08/1995	5.00	PVC	2	65.3	769.37	Intermediate	407995.74	1531834.41
WT115A	Existing	22/08/1995	10.00	PVC	2	17.4	765.87	Shallow	407261.44	1531675.84
WT116A	Existing	17/08/1995	10.00	PVC	2	12.6	763.86	Shallow	406784.998	1531925.717
WT116B	Existing	17/08/1995	5.00	PVC	2	58.4	763.89	Intermediate	406776.004	1531930.916
WT117A	Existing	15/08/1995	10.00	PVC	2	15.5	767.19	Shallow	405908.93	1532201.98
WT117B	Existing	14/08/1995	5.00	PVC	2	61.3	766.6	Intermediate	405896.419	1532202.457
WT118B	Existing	18/08/1995	5.00	PVC	2	62.5	766.49	Intermediate	406361.215	1531917.596
WT119A	Existing	14/10/1998	10.00	PVC	2	17.5	763.26	Shallow	406737.59	1531622.32
WT120A	Unknown	14/10/1998	--	--	--	--	--	--	406610.6816	1531679.974
WT120B	Unknown	14/10/1998	--	--	--	--	--	--	406617.8924	1531681.416

Notes:

Location of abandonned wells are approximate

--	Information unknown
n/a	Not applicable
ns	Not previously sampled
CDA	Construction debris area

TABLE 4.2

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM
HIMCO SITE
ELKHART, INDIANA

Location/Task	Sample Matrix	Field Parameters	Laboratory Parameters [2]	Approximate Number of Samples	QC Samples [1] Field Blanks	QC Samples [1] Field Duplicates	QC Samples [1] MS/MSD [3]	Total
Test Pit Sampling	Soil	PID screening	TCL SVOCs, TAL Metals, Total cyanide.	15	1	1	1	18
Landfill Cover Soil Borings	Soil	PID screening	Grain size distribution, pH, organic content, NPK content	27	0	0	0	27
			TCL VOCs	TBD [4]	0	1 per 20	1 per 20	TBD
Soil Gas Probe Installation (single probes)	Soil	FID/PID screening, water level, gas pressure, methane, oxygen, carbon dioxide	None	24	0	0	0	24
Soil Gas Probe Nests Installation (each nested pair)	Soil	FID/PID screening	Grain size distribution, porosity/water-filled porosity, dry bulk density, vapor permeability, fraction of organic carbon	6	0	0	0	6
Vertical Aquifer Sampling	Groundwater	None	TCL VOCs, TAL Metals, bromide, sulfate, chloride	126	7	7	7	147
Groundwater Sampling	Groundwater	pH, DO, temperature, conductivity, ORP, turbidity, water level	TCL VOCs, TCL SVOCs, TAL Metals, bromide, sulfate, chloride	39 [5]	2	2	2	45
Soil Gas Sampling	Gas	FID/PID screening water level, gas pressure, methane, oxygen, carbon dioxide	VOCs, nitrogen, hydrogen sulfide, carbon monoxide, NMOC	31	0	2	1	34

Notes:

1 One trip blank sample will be included in each cooler containing groundwater samples for VOC analysis.

2 TCL - Target Compound List (TCL), SVOCs - Semi-volatile Organic Compounds (SVOCs), TAL - Target Analyte List, VOCs - Volatile Organic Compounds, NMOC - Non-Methane Organic Compounds, NPK - Nitrogen, Phosphorus, Potassium.

3 Matrix spike/matrix duplicate (MS/MSD) analyses will be performed for organic analyses. MS/MSD samples will be collected with extra sample volume for water samples, at a frequency of 1 per 20 or fewer investigative samples. Triple the normal sample volume will be collected for VOCs and double the normal volume for SVOCs. No additional sample volume is required for inorganic analyses. Duplicate laboratory control samples (LCS/LCSD) will be analyzed at a frequency of 1 per 20 or fewer soil gas samples.

4 To be determined based on headspace PID screening. A soil sample will be collected for VOC analysis if headspace PID reading is greater than 10 ppm above background PID readings.

5 Number based on baseline monitoring of 39 wells to be monitored quarterly for 2 years.

TABLE 4.3

GROUNDWATER SCREENING CRITERIA
HIMCO SITE, ELKHART, IN

Parameter	*Units*	*USEPA Primary MCL a*	*USEPA Secondary MCL b*	*RDA Criteria c*
Volatiles				
1,1,1-Trichloroethane	µg/L	200P	-	
1,1,2,2-Tetrachloroethane	µg/L	-	-	
1,1,2-Trichloroethane	µg/L	5P	-	
1,1-Dichloroethane	µg/L	-	-	
1,1-Dichloroethene	µg/L	7P	-	
1,1-Dichloropropene	µg/L	-	-	
1,2,3-Trichlorobenzene	µg/L	-	-	
1,2,3-Trichloropropane	µg/L	-	-	
1,2,4-Trichlorobenzene	µg/L	70P	-	
1,2,4-Trimethylbenzene	µg/L	-	-	
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	0.2P	-	
1,2-Dibromoethane (Ethylene Dibromide)	µg/L	0.05P	-	
1,2-Dichlorobenzene	µg/L	600P	-	
1,2-Dichloroethane	µg/L	5P	-	
1,2-Dichloroethene (total)	µg/L	-	-	
1,2-Dichloropropane	µg/L	5P	-	
1,3,5-Trimethylbenzene	µg/L	-	-	
1,3-Dichlorobenzene	µg/L	-	-	
1,3-Dichloropropane	µg/L	-	-	
1,4-Dichlorobenzene	µg/L	75P	-	
2,2-Dichloropropane	µg/L	-	-	
2-Butanone (Methyl Ethyl Ketone)	µg/L	-	-	
2-Chloroethyl vinyl ether	µg/L	-	-	
2-Chlorotoluene	µg/L	-	-	
2-Hexanone	µg/L	-	-	
2-Phenylbutane (sec-Butylbenzene)	µg/L	-	-	
4-Chlorotoluene	µg/L	-	-	
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	µg/L	-	-	
Acetone	µg/L	-	-	
Acrolein	µg/L	-	-	
Acrylonitrile	µg/L	-	-	
Benzene	µg/L	5P	-	
Bromobenzene	µg/L	-	-	
Bromodichloromethane	µg/L	-	-	
Bromoform	µg/L	-	-	
Bromomethane (Methyl Bromide)	µg/L	-	-	
Carbon disulfide	µg/L	-	-	
Carbon tetrachloride	µg/L	5P	-	
Chlorobenzene	µg/L	100P	-	
Chlorobromomethane	µg/L	-	-	
Chloroethane	µg/L	-	-	
Chloroform (Trichloromethane)	µg/L	80	-	
Chloromethane (Methyl Chloride)	µg/L	-	-	
cis-1,2-Dichloroethene	µg/L	70P	-	
cis-1,3-Dichloropropene	µg/L	-	-	
Cymene (p-Isopropyltoluene)	µg/L	-	-	
Dibromochloromethane	µg/L	-	-	
Dichlorofluoromethane	µg/L	-	-	
Ethyl Ether	µg/L	-	-	
Ethylbenzene	µg/L	700P	-	
Hexachlorobutadiene	µg/L	-	-	
Isopropylbenzene	µg/L	-	-	
m&p-Xylene	µg/L	10000P	-	
Methylene chloride	µg/L	5P	-	

TABLE 4.3

GROUNDWATER SCREENING CRITERIA
HIMCO SITE, ELKHART, IN

Parameter	*Units*	*USEPA Primary MCL a*	*USEPA Secondary MCL b*	*RDA Criteria c*
Naphthalene	µg/L	-	-	
n-Butylbenzene	µg/L	-	-	
n-Propylbenzene	µg/L	-	-	
o-Xylene	µg/L	10000P	-	
Styrene	µg/L	100P	-	
tert-Butylbenzene	µg/L	-	-	
Tetrachloroethene	µg/L	5P	-	
Toluene	µg/L	1000P	-	
Total VOCS	µg/L	-	-	
trans-1,2-Dichloroethene	µg/L	100P	-	
trans-1,3-Dichloropropene	µg/L	-	-	
Trichloroethene	µg/L	5P	-	
Trichlorofluoromethane (CFC-11)	µg/L	-	-	
Vinyl acetate	µg/L	-	-	
Vinyl chloride	µg/L	2P	-	
Xylene (total)	µg/L	10000P	-	
Semi-Volatiles				
1,2,4-Trichlorobenzene	µg/L	70P	-	
1,2-Dichlorobenzene	µg/L	600P	-	
1,2-Diphenylhydrazine	µg/L	-	-	
1,3-Dichlorobenzene	µg/L	-	-	
1,4-Dichlorobenzene	µg/L	75P	-	
2(3H)-Benzothiazolone	µg/L	-	-	
2,2'-oxybis(1-Chloropropane) (bis(2-chloroisopropyl) ether)	µg/L	-	-	
2,4,5-Trichlorophenol	µg/L	-	-	
2,4,6-Trichlorophenol	µg/L	-	-	
2,4-Dichlorophenol	µg/L	-	-	
2,4-Dimethylphenol	µg/L	-	-	
2,4-Dinitrophenol	µg/L	-	-	
2,4-Dinitrotoluene	µg/L	-	-	
2,6-Dinitrotoluene	µg/L	-	-	
2-Chloronaphthalene	µg/L	-	-	
2-Chlorophenol	µg/L	-	-	
2-Methylnaphthalene	µg/L	-	-	
2-Methylphenol	µg/L	-	-	
2-Nitroaniline	µg/L	-	-	
2-Nitrophenol	µg/L	-	-	
3,3'-Dichlorobenzidine	µg/L	-	-	
3-Nitroaniline	µg/L	-	-	
4,6-Dinitro-2-methylphenol	µg/L	-	-	
4-Bromophenyl phenyl ether	µg/L	-	-	
4-Chloro-3-methylphenol	µg/L	-	-	
4-Chloroaniline	µg/L	-	-	
4-Chlorophenyl phenyl ether	µg/L	-	-	
4-Methylphenol	µg/L	-	-	
4-Nitroaniline	µg/L	-	-	
4-Nitrophenol	µg/L	-	-	
Acenaphthene	µg/L	-	-	
Acenaphthylene	µg/L	-	-	
Aniline	µg/L	-	-	
Anthracene	µg/L	-	-	
Benzidine	µg/L	-	-	
Benzo(a)anthracene	µg/L	-	-	
Benzo(a)pyrene	µg/L	0.2P	-	
Benzo(b)fluoranthene	µg/L	-	-	

TABLE 4.3

GROUNDWATER SCREENING CRITERIA
HIMCO SITE, ELKHART, IN

Parameter	*Units*	*USEPA Primary MCL a*	*USEPA Secondary MCL b*	*RDA Criteria c*
Benzo(g,h,i)perylene	µg/L	-	-	
Benzo(k)fluoranthene	µg/L	-	-	
Benzoic acid	µg/L	-	-	
Benzyl Alcohol	µg/L	-	-	
bis(2-Chloroethoxy)methane	µg/L	-	-	
bis(2-Chloroethyl)ether	µg/L	-	-	
bis(2-Ethylhexyl)phthalate	µg/L	6P	-	
Butyl benzylphthalate	µg/L	-	-	
Carbazole	µg/L	-	-	
Chrysene	µg/L	-	-	
Dibenz(a,h)anthracene	µg/L	-	-	
Dibenzofuran	µg/L	-	-	
Diethyl phthalate	µg/L	-	-	
Dimethyl phthalate	µg/L	-	-	
Di-n-butylphthalate	µg/L	-	-	
Di-n-octyl phthalate	µg/L	-	-	
Fluoranthene	µg/L	-	-	
Fluorene	µg/L	-	-	
Hexachlorobenzene	µg/L	1P	-	
Hexachlorobutadiene	µg/L	-	-	
Hexachlorocyclopentadiene	µg/L	50P	-	
Hexachloroethane	µg/L	-	-	
Indeno(1,2,3-cd)pyrene	µg/L	-	-	
Isophorone	µg/L	-	-	
Naphthalene	µg/L	-	-	
Nitrobenzene	µg/L	-	-	
N-Nitrosodimethylamine	µg/L	-	-	
N-Nitrosodi-n-propylamine	µg/L	-	-	
N-Nitrosodiphenylamine	µg/L	-	-	
Pentachlorophenol	µg/L	1P	-	
Phenanthrene	µg/L	-	-	
Phenol	µg/L	-	-	
Pyrene	µg/L	-	-	
Total SVOCS	µg/L	-	-	
Metals				
Aluminum	µg/L	-	50S	
Antimony	µg/L	6P	-	
Arsenic	µg/L	10P	-	
Barium	µg/L	2000P	-	
Beryllium	µg/L	4P	-	
Cadmium	µg/L	5P	-	
Calcium	µg/L	-	-	250000
Chromium Total	µg/L	100P	-	
Cobalt	µg/L	-	-	
Copper	µg/L	-	1000S	
Cyanide (total)	µg/L	-	-	
Iron	µg/L	-	300S	1000
Lead	µg/L	15	-	
Magnesium	µg/L	-	-	
Manganese	µg/L	-	50S	
Mercury	µg/L	2P	-	
Nickel	µg/L	-	-	
Potassium	µg/L	-	-	
Selenium	µg/L	50P	-	
Silver	µg/L	-	100S	

TABLE 4.3

GROUNDWATER SCREENING CRITERIA
HIMCO SITE, ELKHART, IN

Parameter	*Units*	*USEPA Primary MCL a*	*USEPA Secondary MCL b*	*RDA Criteria c*
Sodium	µg/L	-	-	150000
Thallium	µg/L	2P	-	
Tin	µg/L	-	-	
Vanadium	µg/L	-	-	
Zinc	µg/L	-	5000S	
PCBs				
Aroclor-1016 (PCB-1016)	µg/L	-	-	
Aroclor-1221 (PCB-1221)	µg/L	-	-	
Aroclor-1232 (PCB-1232)	µg/L	-	-	
Aroclor-1242 (PCB-1242)	µg/L	-	-	
Aroclor-1248 (PCB-1248)	µg/L	-	-	
Aroclor-1254 (PCB-1254)	µg/L	-	-	
Aroclor-1260 (PCB-1260)	µg/L	-	-	
Total PCBs	µg/L	0.5P	-	
Pesticides				
4,4'-DDD	µg/L	-	-	
4,4'-DDE	µg/L	-	-	
4,4'-DDT	µg/L	-	-	
Aldrin	µg/L	-	-	
alpha-BHC	µg/L	-	-	
alpha-Chlordane	µg/L	-	-	
beta-BHC	µg/L	-	-	
delta-BHC	µg/L	-	-	
Dieldrin	µg/L	-	-	
Endosulfan I	µg/L	-	-	
Endosulfan II	µg/L	-	-	
Endosulfan sulfate	µg/L	-	-	
Endrin	µg/L	2P	-	
Endrin aldehyde	µg/L	-	-	
Endrin ketone	µg/L	-	-	
gamma-BHC (Lindane)	µg/L	0.2P	-	
gamma-Chlordane	µg/L	-	-	
Heptachlor	µg/L	0.4P	-	
Heptachlor epoxide	µg/L	0.2P	-	
Methoxychlor	µg/L	40P	-	
Total Pesticides	µg/L	-	-	
Toxaphene	µg/L	3P	-	
General Chemistry				
Bromide	µg/L	-	-	
Chloride	mg/L	-	250S	
Sulfate	mg/L	-	250S	

Criteria Notes:
P - Primary Maximum Contaminant Level.
S - Secondary Maximum Contaminant Level.

TABLE 4.4

SOIL SCREENING CRITERIA
HIMCO SITE, ELKHART, IN

Parameter	Units	*IDEM Residential/Default Closure Levels*	IDEM *Industrial/Default Closure Levels*
Semi-volatile Organic Compounds			
2,2'-oxybis(1-Chloropropane) (bis(2-chloroisopropyl) ether)	mg/kg	0.027	0.26
2,4,5-Trichlorophenol	mg/kg	250	690
2,4,6-Trichlorophenol	mg/kg	0.07	0.2
2,4-Dichlorophenol	mg/kg	1.1	3
2,4-Dimethylphenol	mg/kg	9	25
2,4-Dinitrophenol	mg/kg	0.29	0.82
2-Chloronaphthalene	mg/kg	42	560
2-Chlorophenol	mg/kg	0.75	10
2-Methylnaphthalene	mg/kg	3.1	42
2-Methylphenol	mg/kg	14	39
2-Nitroaniline	mg/kg	0.67	1.9
3,3'-Dichlorobenzidine	mg/kg	0.062	0.21
3-Methylphenol	mg/kg	9.8	28
4-Chloroaniline	mg/kg	0.97	2.7
4-Methylphenol	mg/kg	1.1	3
Acenaphthene	mg/kg	130	1200
Acenaphthylene	mg/kg	18	180
Anthracene	mg/kg	51	51
Atrazine	mg/kg	0.048	0.21
Benzo(a)anthracene	mg/kg	5	15
Benzo(a)pyrene	mg/kg	0.5	1.5
Benzo(b)fluoranthene	mg/kg	5	15
Benzo(g,h,i)perylene	mg/kg	16	16
Benzo(k)fluoranthene	mg/kg	39	39
bis(2-Chloroethyl)ether	mg/kg	0.0007	0.012
bis(2-Ethylhexyl)phthalate	mg/kg	300	980
Butyl benzylphthalate	mg/kg	310	310
Carbazole	mg/kg	5.9	20
Chrysene	mg/kg	25	25
Dibenz(a,h)anthracene	mg/kg	0.5	1.5
Dibenzofuran	mg/kg	4.9	65
Diethyl phthalate	mg/kg	450	840
Dimethyl phthalate	mg/kg	1100	1100
Di-n-butylphthalate	mg/kg	760	760
Di-n-octyl phthalate	mg/kg	2000	2000
Fluoranthene	mg/kg	880	880
Fluorene	mg/kg	170	1100
Hexachlorobenzene	mg/kg	2.2	3.9
Hexachlorobutadiene	mg/kg	24	66
Hexachlorocyclopentadiene	mg/kg	400	720
Hexachloroethane	mg/kg	2.8	7.7
Indeno(1,2,3-cd)pyrene	mg/kg	3.1	3.1
Isophorone	mg/kg	5.3	18
Naphthalene	mg/kg	0.7	170
Nitrobenzene	mg/kg	0.028	0.34
N-Nitrosodi-n-propylamine	mg/kg	0.0006	0.002
N-Nitrosodiphenylamine	mg/kg	9.7	32
Pentachlorophenol	mg/kg	0.028	0.66
Phenanthrene	mg/kg	13	170
Phenol	mg/kg	56	160
Pyrene	mg/kg	570	570

TABLE 4.4

SOIL SCREENING CRITERIA
HIMCO SITE, ELKHART, IN

Parameter	Units	*IDEM Residential/Default Closure Levels*	IDEM *Industrial/Default Closure Levels*
Inorganics			
Antimony	mg/kg	5.4	37
Arsenic	mg/kg	3.9	5.8
Barium	mg/kg	1600	10000
Beryllium	mg/kg	63	2300
Cadmium	mg/kg	7.5	77
Chromium Total	mg/kg	38	120
Copper	mg/kg	920	2900
Lead	mg/kg	81	230
Mercury	mg/kg	2.1	32
Nickel	mg/kg	950	2700
Selenium	mg/kg	5.2	53
Silver	mg/kg	31	87
Thallium	mg/kg	2.8	10
Zinc	mg/kg	10000	10000
Cyanide	mg/kg	0.94	9.6